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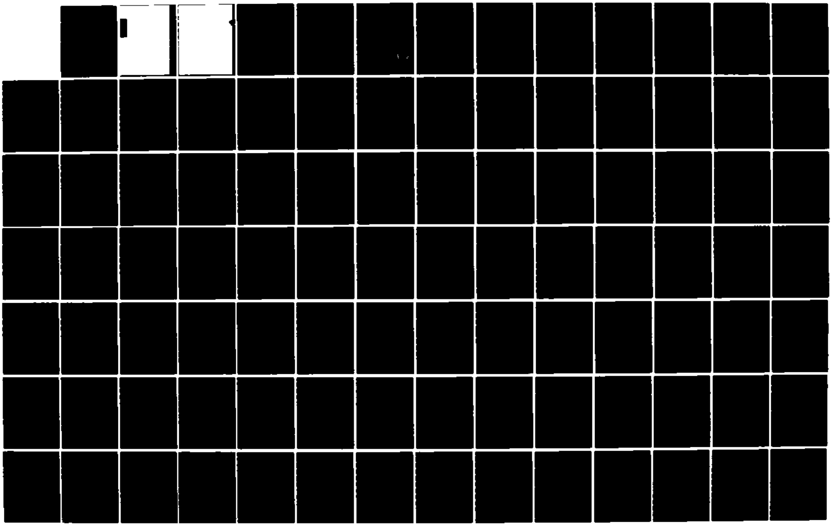

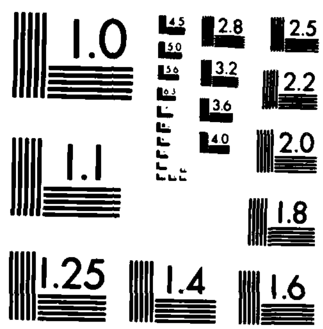


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The basic Parts Requirements and Cost Model (~~basic~~ PARCOM), developed at the US Army Concepts Analysis Agency, was redesigned to include partial substitution parts replacement policies and other features lacking in the basic PARCOM. The redesigned model is documented and denoted as Extended PARCOM. Extended PARCOM provides the Army with an analytical tool for quick reaction, gross estimation of wartime spare parts requirements and costs as they relate to flying hour and availability objectives and to part replacement policies. The model also assists in the identification of problem parts and possible causes of the



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20. ABSTRACT Continued

problems. The Extended PARCOM Functional Descriotion is structured to provide a user with detailed information on Extended PARCOM model logic and restrictions. Additional information on model application may be found in the Extended PARCOM User's Guide, published separately.

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# EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM) FUNCTIONAL DESCRIPTION

## (Short title: Extended PARCOM Functional Description)

MARCH 1985

PREPARED BY
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# EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM) FUNCTIONAL DESCRIPTION

(Short title: Extended PARCOM Functional Description)

## CHAPTER 1

## GENERAL DESCRIPTION

**1-1. PURPOSE OF THE FUNCTIONAL DESCRIPTION.** This functional description of the Extended Parts Requirements and Cost Model (PARCOM) provides:

**a.** The structure of the model logic which will serve as a basis for mutual understanding between the user and the developer.

**b.** Information on model restrictions, potential for extension, and user impacts.

**1-2. PROJECT REFERENCES.** The reader is directed to the reference list in Appendix B of this document.

**1-3. TERMS AND ABBREVIATIONS.** The reader is directed to the glossary at the end of this document.

**1-4. BACKGROUND**

**a. Model Origin.** The US Army Concepts Analysis Agency (CAA) developed the Parts Requirements and Cost Model (PARCOM) to generate cost-effective mixes of aircraft spare parts and to assess aircraft fleet performance under specified wartime scenario conditions. Development occurred during the course of the Aircraft Spare Stockage Methodology (Aircraft Spares) Study[1] conducted by CAA. That study, and PARCOM development, were in response to interest shown by the Deputy Chief of Staff for Logistics (DCSLOG) in developing a methodology (or methodologies) relating aircraft spare parts stockage levels to combat readiness and flying hour capability. The calculation of spare parts requirements and of the effects of budgeting changes had been a slow and cumbersome peacetime-oriented exercise. The principal criterion for spares stockage had been the achievement of acceptable stockout, or fill rate, levels. To more realistically predict wartime spare parts requirements, and to better justify budget requests for spare parts procurement, the Army needed a more responsive methodology based on wartime flying hour expectations and system readiness/availability requirements. At first, the Army used the Overview Model,[1,2] but later PARCOM was developed to meet that need.

**b. Documentation.** Results reported in the Aircraft Spares Study were sufficiently encouraging to warrant a follow-on study designated the Overview/PARCOM Turnkey Project (OPTP).[2] Included in the objectives of OPTP were the following actions pertaining to PARCOM:

(1) Document PARCOM, as developed in the Aircraft Spares Study, and deliver it to the US Army Aviation Systems Command (AVSCOM). That documentation consisted of a User's Guide[3] and a Functional Description.[4]

(2) Evaluate and report on the potential for extending the capability of the PARCOM methodology to include partial-substitution parts replacement policies and any other features deemed desirable but lacking in the version of the model developed for Aircraft Spares. The version of PARCOM developed in OPTP is denoted as Extended PARCOM, while the Aircraft Spares version is denoted as basic PARCOM. A technical paper[5] was issued describing Extended PARCOM methodology. This report is a functional description of the new version of the model. An Extended PARCOM User's Guide[6] has also been prepared.

## 1-5. STRUCTURE OF ARMY AIRCRAFT LOGISTICS

**a. Governing Regulations.** Policy and procedural guidance for the Army's inventory management efforts is largely contained in two regulations:

- AR 710-1, Centralized Inventory Management of the Army Supply System
- AR 710-2, Supply Policy Below the Wholesale Level

(1) AR 710-1 establishes responsibilities and procedures for centralized inventory management of Army materiel by the major subordinate commands (MSC) of the US Army Materiel Command (AMC).

(2) AR 710-2 prescribes supply procedures to be used at the retail level, including methods for determining authorized stockage lists and appropriate stockage levels.

**b. Maintenance System Structure.** Figure 1-1 illustrates the interaction of supply, maintenance, and industrial activities within the aircraft parts logistics system.

(1) **Parts Storage Locations.** Aircraft spare parts are stored with using units at the aviation unit maintenance (AVUM) and the aviation intermediate maintenance (AVIM) levels. Aircraft spare parts are stored in various CONUS depots for shipment to users upon requisition. Additionally, war reserve parts are stored in various CONUS depots or prepositioned in the appropriate theater.

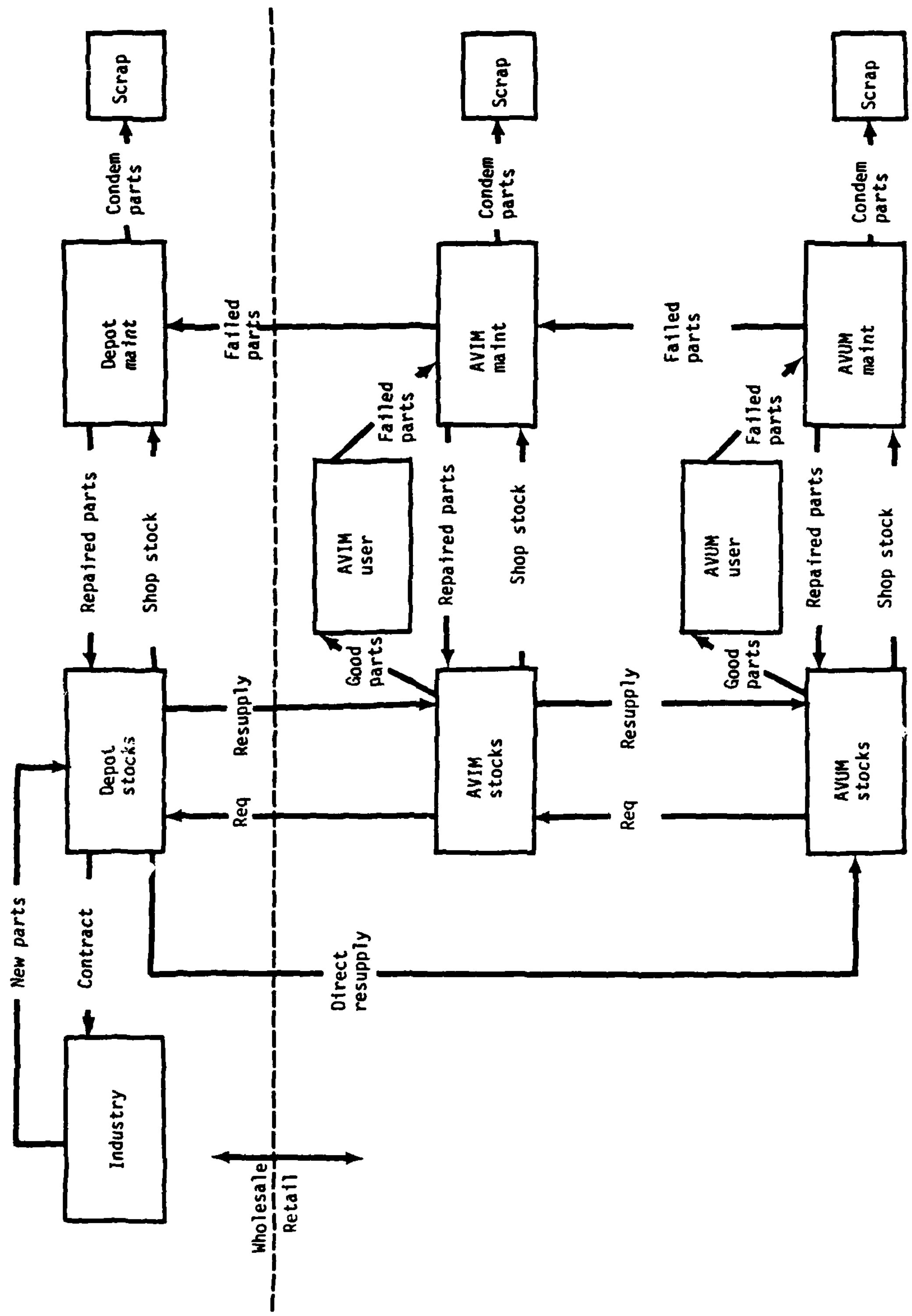


Figure 1-1. Aircraft Parts Logistics System

**(2) Participating Organizations and Responsibilities.** AVUM facilities are organic to the lower echelon aviation units which actually fly and maintain the Army's aircraft. These user units stock a prescribed load list (PLL) of repair parts at the AVUM level. PLLs are sized to sustain the unit's anticipated wartime flight operations for a specified number of days (usually 15). Stockage levels and reordering procedures are governed by AR 710-2. AVIM units develop their own authorized stockage lists (ASL) based on demands for parts received from supported AVUM units and from their own AVIM operations. AVIM ASLs are exclusive of subordinate unit PLLs. The development of ASLs is also governed by AR 710-2. Part types are selected for PLL and ASL stockage based upon a combination of experienced demand frequency and mission essentiality. The AVIM/AVUM (retail) parts requirements are supported by stocks maintained in supply depots (wholesale) in CONUS. Automated inventory management techniques are employed by AVSCOM to authorize and record fill of retail requisitions by the appropriate wholesale depot. Depot stocks are replenished through procurement of new parts or repair of returned unserviceables.

**c. Areas of Consideration**

**(1) Peacetime versus Wartime.** Peacetime requirements for spare parts are computed based upon experienced annual demand and projected peacetime usage. AVSCOM uses an automated system of data bases and models to forecast these requirements, and bases its computations on a supply availability goal. Wartime requirements are computed and funded separately from peacetime requirements, and address those parts required to sustain the force during the initial stages of war until lines of communication and supply can be established. The primary consideration for peacetime requirements is meeting supply availability goals, while that for war reserve requirements is meeting sustainability goals.

**(2) Initial Provisioning versus Replenishment.** Computation of the spare parts requirement for initial provisioning of new weapons systems is necessarily based on less concrete data than is that for replenishment parts for already fielded systems. No demand history has yet been developed, so engineering estimates of parts failure factors are used instead. In many cases, all the parts to be included in the new aircraft have not been fully identified, and their cost must be extrapolated from that of a list of major assemblies. AVSCOM has an automated capability to compute initial provisioning requirements based on these projected data. Over the first 2 years of a system's life, actual demand data is accumulated and given increasing weight in spare parts management decisions. After a system has been fielded for 2 years, its replenishment spare parts requirements are computed using actual demand data to the maximum extent possible.

**(3) Retail versus Wholesale.** The Army splits its inventory management into "retail" and "wholesale" activities. In the aviation logistics context, AVUM- and AVIM-level parts stockages are termed "retail," while those at the depot level are termed "wholesale." The methodologies used to compute spare parts requirements for the retail and wholesale levels are entirely different and essentially unrelated. Retail stockage levels are computed and authorized based upon a combination of demand experience, combat essentiality, and mobility requirements. AR 710-2 establishes computational procedures used by retail parts managers to determine their stockage levels and appropriate reorder points. Wholesale parts requirements are computed based upon average monthly demand experienced at the wholesale level. Wholesale item managers have little visibility of retail spare parts postures or weapons system availabilities. Rather, wholesale parts are procured or repaired at rates calculated to achieve a chosen demand satisfaction percentage without backorders.

**(4) Fill Rate versus System Availability Criteria.** AVSCOM computes spare parts requirements with the objective of achieving a target fill rate. Its goal is to fill a selected percentage of all demands received without having to backorder parts. The item manager does not base his parts management decisions on weapons system availability, and in fact, has little or no visibility of this retail level criterion. The Department of Defense (DOD) has expressed its support for implementation of system availability-driven parts requirements computation methodologies in all the armed services. The primary difficulty for the Army is the collection of accurate data to drive such automated models.

**d. Similarity of Aircraft and Other Spares Procurement.** Each of the MSCs uses the Commodity Command Standard System (CCSS) to meet its inventory management responsibilities. The processes used are essentially the same for all types of spares.

**1-6. EXTENDED PARCOM REPRESENTATION OF LOGISTICS ENVIRONMENT.** The Extended PARCOM "world view" of the aircraft part logistics system is based on the representation in Figure 1-1. Extended PARCOM, however, has only two echelons of stock and repair.

**a. Wholesale Level.** This level consists of the "depot stocks" and "depot maintenance" blocks of Figure 1-1. Depot maintenance is represented in terms of depot repair times, depot condemnation rates, and order ship times (OST) between depot and retail level. Extended PARCOM treats initial wholesale stocks in four categories. Initial depot serviceables are shipped to theater according to a user-specified schedule. Initial depot unserviceables are repaired or condemned at depot; completed repairs are shipped to theater. Serviceable war reserve stocks are assumed in place in theater. Unserviceable war reserve stocks are treated as failed parts and are condemned or shipped to repair as appropriate.

**b. Retail Level.** This level is treated as one pool (or "bin") of spare parts stocks consisting of all stocks at AVIM and AVUM levels in Figure 1-1. Retail maintenance is treated as an aggregate process and is represented in terms of retail repair times, not repairable this station (NRTS) percentages, and retail condemnation rates. Essentially, "retail" represents pooled AVIM and AVUM functions. Deploying ASL/PLL stocks arrive in theater according to a user-specified schedule.

c. **Distribution of Parts Over Time.** Extended PARCOM distributes parts over intervals of 5 days rather than over individual days. All parts due to be received during a given 5-day interval are distributed uniformly throughout that interval. An exception is Day 1 of the scenario. All parts due in (or in place) on Day 1 are treated as received at the beginning of Day 1. The categories of parts treated are:

(1) **Depot Serviceables.** These consist of serviceable parts located at depot at the start of the scenario. For each part, the initial stock of depot serviceables is entered in the part data base input. The scenario input specifies a depot lag, L, and a depot distribution time, D, applicable to all parts, such that, for each part, the initial stock of depot serviceables is distributed (received at retail) uniformly between Day (L + 1) and Day (L + D).

(2) **Depot Unserviceables.** These consist of unserviceable parts located at depot at the start of the scenario. They are at various stages of the depot repair process and, after repair, are to be shipped to retail. Since a part may be in any state of its repair cycle, distribution of uncondemned depot unserviceables for each part is assumed uniform over an interval equal to the depot repair time (DRT) for the part, with the first receipt (at retail) after a lag equal to the order ship time (OST) for the part. For each part, the initial stock of depot unserviceables, the depot condemnation rate (DC), the OST, and the depot repair time are input in the part data base. Letting A = number of depot unserviceables, Extended PARCOM distributes (1-DC) x A repaired parts at retail between Day (OST + 1) and Day (OST + DRT).

(3) **War Reserve Serviceables.** These consist of serviceable parts in the war reserve located at retail. For each part, the amount of the serviceable war reserve is input in the parts data base. The entire stock is treated as available at retail from the scenario start (Day 1).

(4) **War Reserve Unserviceables.** These consist of unserviceable war reserve parts located at retail at the start of the scenario. Some of these will be condemned. Others will be sent to depot for repairs. Others are in various stages of repair at retail. The distribution of these parts is as follows:

(a) **Items Repairable at Retail.** For each part, let NRTS = the NRTS fraction, BR = the retail repair time, BC = retail condemnation rate, and A = number of war reserve unserviceables. Then, Extended PARCOM simulates the receipt in theater, between Day 1 and Day BR, of (1-NRTS) x A x (1-BC) parts repaired at retail. All of these factors are input in the parts data base.

(b) **Items not Repairable at Retail.** For each part, let NRTS = the NRTS fraction, DRT = the depot repair time, DC = depot condemnation rate, OST = the order ship time, and A = number of war reserve unserviceables. Then, Extended PARCOM returns to the theater (NRTS) x A x (1-DC) depot-repaired parts between (2 x OST + 1) and Day (2 x OST + DRT).

(5) **ASL/PLL Deployments.** For each part, the Extended PARCOM parts data base inputs on Day 1 include total in-place ASL/PLL parts. In addition, total ASL/PLL parts deployed after Day 1 are input for successive 5-day intervals of the scenario.

d. **Users.** Users of spare parts are deployed aircraft. Extended PARCOM treats deployed aircraft only at retail level. These are augmented by scheduled deployments of additional aircraft (from a presumed rear area) during the course of a simulated "war." Currently, Extended PARCOM can treat only a homogeneous aircraft fleet of one type for a single force. Deployed aircraft are subject to attrition based on (input) attrition factors. Combat is not explicitly represented.

e. **Failure Generation.** The deployed aircraft fleet is assigned (via input) a flying hour program, broken into daily fleet flying hour requirements. Extended PARCOM finds a cost-effective mix of spare parts, which, over the course of the "war," will, on average, achieve the set flying program in addition to specified daily aircraft availability requirements. If spares procurement funds are constrained, Extended PARCOM seeks a cost-effective spares mix achieving as much of the flying program as possible. Input failure rates for spare parts are in terms of failures per flying hour. In general, achieved flying hours interact with part failure rates to produce gross part failures. Gross part failures interact with issues from initial spare inventory and the repair process at depot and at retail to produce a net demand for spare parts at user level. The net demand for spare parts at user level then determines the number of surviving aircraft that are mission capable or not mission capable supply (NMCS). As will be seen in the next chapter, Extended PARCOM simulates all interactions in expected value terms, i.e., in terms of the product of an average process rate and the number of items subjected to that process.

**1-7. EXTENDED PARCOM PROBLEM SPECIFICATION.** The basic purpose of Extended PARCOM is to generate cost-effective mixes of add-on spare parts needed to permit an aircraft fleet of specified type to achieve specified flying program and availability goals under various cost constraints and aircraft availability objectives for a user-specified part replacement policy. These are described below in summary fashion. Additional detail may be found in the Extended PARCOM User's Guide.

a. **Cost Constraints.** The two cost constraint modes are:

(1) **Unconstrained Funds** - where unlimited funds for procurement of additional required parts are assumed available.

(2) **Constrained Funds** - where a cost (funding) limit for add-on spares is set. If unable to meet the flying hour, and possibly, availability objectives with the limited funds, the model generates a "best" solution mix with the funds available, i.e., it seeks to maximize program flying hours achievable within the funding constraint.

**b. Parts Replacement Policies.** Whether or not a failed critical part degrades aircraft flying hour productivity depends on the parts replacement policy used. Basic PARCOM represented the effects on only two specific policies, full substitution and no substitution. These policies are special cases of the partial-substitution policy capability of Extended PARCOM.

**(1) Full and No Substitution.** Under a no-substitution policy, only a spare may replace a failed part. Under a full-substitution policy, a failed part may be replaced by either a spare **or**, if a spare is not readily available, by a serviceable part removed from an aircraft which is already NMC (not mission capable). A third parts replacement policy is "NMCS = 0," which has, as a goal, the replacement of **all** failed parts with spares. Basically, the "NMCS = 0" policy is just a no-substitution policy with an additional requirement that daily aircraft availability be 1.00. This variation is of interest since it represents the most expensive plausible policy. In a sense, all else being equal, a full-substitution policy is associated with the "cheapest" buy which fulfills the flying program, while the "NMCS = 0" policy is associated with the "most expensive" buy ("covering" all failures with spares).

**(2) Partial Substitution.** In Extended PARCOM, a partial-substitution parts replacement policy is defined by partitioning all part types into a full-sub set and a no-sub set. A part type is in only one set and remains in that set throughout the scenario. The full-substitution and no-substitution policies of the basic PARCOM are special cases of partial substitution in which all parts are either in the full-sub set or in the no-sub set. The analytic usefulness of the definition arises from the consequence that any NMCS aircraft will either be awaiting exactly one no-sub part or at least one full-sub part but will never be awaiting a mixture of full-sub and no-sub parts.

**(a)** All parts in the full-sub set operate with a full-substitution replacement policy relative to aircraft which are NMCS due to lack of a part from that set. That is, a failed full-sub part on an aircraft may be replaced either by a spare (if available) or by a serviceable part installed on an NMCS aircraft which is awaiting a full-sub part, if a spare is not available. However, no failed full-sub part can be replaced by any part installed on an NMCS aircraft awaiting a no-sub part.

**(b)** Parts in the no-sub set operate with a no-substitution replacement policy. That is, a failed no-sub part on an aircraft may only be replaced by a spare part. An NMCS aircraft lacking a no-sub part may neither receive a serviceable part from another NMCS aircraft nor provide a serviceable part to (fill a hole in) any other NMCS aircraft.

**c. Flying Hour Objective.** A flying hour objective is a requirement for the aircraft fleet to achieve a specified number of program flying hours on each day of the scenario. An input flying hour program designates the daily goals. The Extended PARCOM objective is to generate a parts mix which will achieve the specified flying program at least cost.

**d. Aircraft Availability Objective.** An aircraft availability objective is a requirement for a specific minimum aircraft availability on each day (different days may have different minimum required availabilities). In this context, aircraft availability = 1 - NMCS, where NMCS = the fraction of surviving aircraft in "not mission capable supply" status. An aircraft is in an NMCS status if it is nonoperational because a spare part is needed but is not available to restore it to serviceability. Specification of availability objectives is in addition to the flying hour objective. Specification of a zero availability objective is equivalent to no availability objective at all.

**1-8. SUMMARY OF EXTENDED PARCOM OUTPUT.** The following are the basic types of print output produced by Extended PARCOM for requirements problems. Details may be found in the Extended PARCOM User's Guide.

**a. Unconstrained Cost Cases**

**(1) Total Requirement.** The least-cost parts mix and costs required to achieve the case objectives (flying program and availability) given a zero initial inventory.

**(2) Residual Requirement.** The least-cost add-on parts mix (to an input initial inventory) and costs required to achieve the case objectives.

**(3) Cumulative Cost by Day.** For each day N (N=1, 2, ..., through end of "war"), the total and the add-on cost of the full parts requirement to meet the case objectives through day N only, i.e., it is the cost of the requirement for a truncated scenario of N days. Parts mix is not shown.

**(4) Cumulative Requirement by Day.** For selected parts, for each day N, the cumulative total and residual requirement needed (in the full parts scenario) to meet the case objectives through N days.

**(5) Daily Aircraft Available.** For each day of the full scenario, the fraction of surviving aircraft which are **not** NMCS, assuming that the computed solution parts mix is stocked in the theater war reserve.

**(6) Daily Flying Hours per Aircraft per Day.** For each day of the scenario, the average achieved flying hours per available aircraft per day, assuming that the computed solution parts mix is stocked in the theater war reserve.

**b. Constrained Costs**

**(1) Total Requirement.** Total "best" requirements mix, with zero initial inventory, that can be bought with a user-specified funding limit. The principal objective of a "best" mix is to maximize flying hour productivity with the constrained funds.

**(2) Residual Requirement.** Best add-on (to input initial inventory) requirements mix that can be bought with a user-specified funding limit.

(3) **Daily Aircraft Available.** For each day of the full scenario, the fraction of surviving aircraft which are **not** NMCS, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

(4) **Daily Flying Hour Fraction.** For each day of the full scenario, the fraction of the fleet flying program which can be achieved, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

(5) **Daily Flying Hours per Aircraft per Day.** For each day of the scenario, the average achieved flying hours per aircraft per day, assuming that the computed constrained cost solution parts mix is stocked in the theater war reserve.

**1-9. TYPICAL PROBLEMS ADDRESSED.** A single Extended PARCOM run can provide answers to several problems pertinent to a given scenario. From the user point of view, typical problem statements, given a specified aircraft deployment schedule, flying program, part replacement policy, and attrition scenario are:

**a.** What is the least cost add-on buy needed to achieve the flying program <u>and</u> an NMCS fraction not exceeding 0.15 on any day? What is the associated daily NMCS status?

**b.** With a budget limit of $10,000,000, what spares should be added to current inventory, using a specified partial substitution policy, to increase to the extent possible the fraction of the flying program achieved? What is the associated daily NMCS status? What is the associated fraction of the flying program that is achievable?

# CHAPTER 2

# PARCOM LOGIC

**2-1. PROCESSING SEQUENCE.** Extended PARCOM is a series of expected value simulations of the spare part requirements generation process for cases defined by a combination of parameters noted in the previous chapter. The model determines a cost-effective solution spares mix for each case. In addition, the model computes the capability potential of the force when operated with each computed spares mix. The assessed capability potential is in terms of achievable aircraft availability and fraction of the flying hour program which can be accomplished. Figure 2-1 illustrates the general nature and sequence of Extended PARCOM processing. The basic model sequence, with logic diagrams as appropriate, is described in succeeding paragraphs.

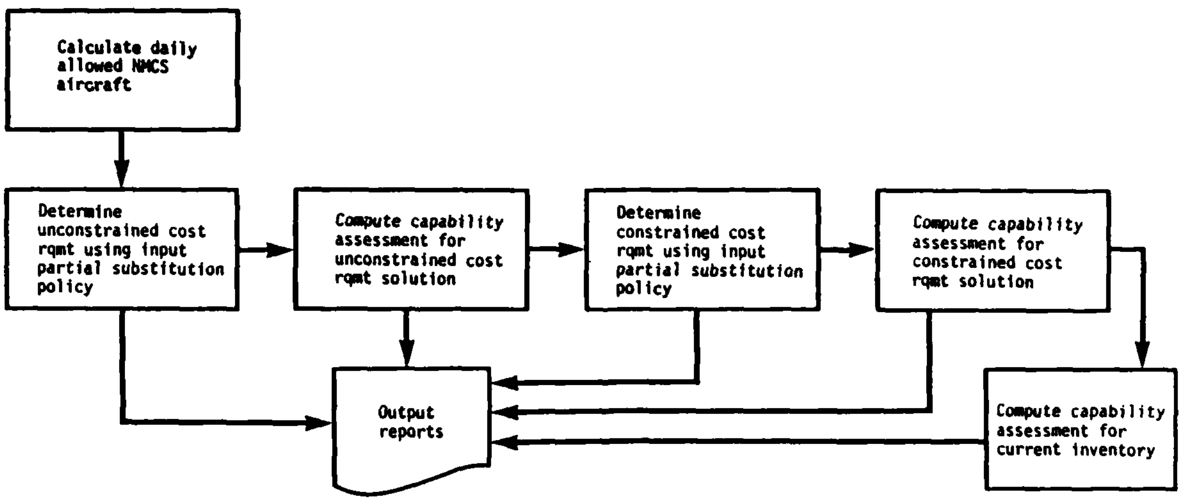


Figure 2-1. Extended PARCOM Processing Sequence

**2-2. ALGORITHM FOR CALCULATING ALLOWABLE NMCS AIRCRAFT.** To meet flying hour and availability goals, the maximum number of aircraft allowed to be down due to a lack of parts (allowable NMCS aircraft) is determined for each day. As shown in Figure 2-2, separate minimums are computed for aircraft required to meet the flying objective and those required to meet the availability objective (if any). The larger of the two minimums is subtracted from the number of surviving aircraft on each day to yield the "allowable NMCS aircraft" for that day. Within the subsequent processing algorithms, the "allowable NMCS aircraft" is converted to an "allowable stockout" for each part and replacement policy. The "allowable stockout" for a part on a day is just the maximum number of backorders (unfilled demands) for the part which will still allow accomplishment of the case objective (flying hour and availability) on that day, i.e., these are parts that are missing but which do not have to be bought.

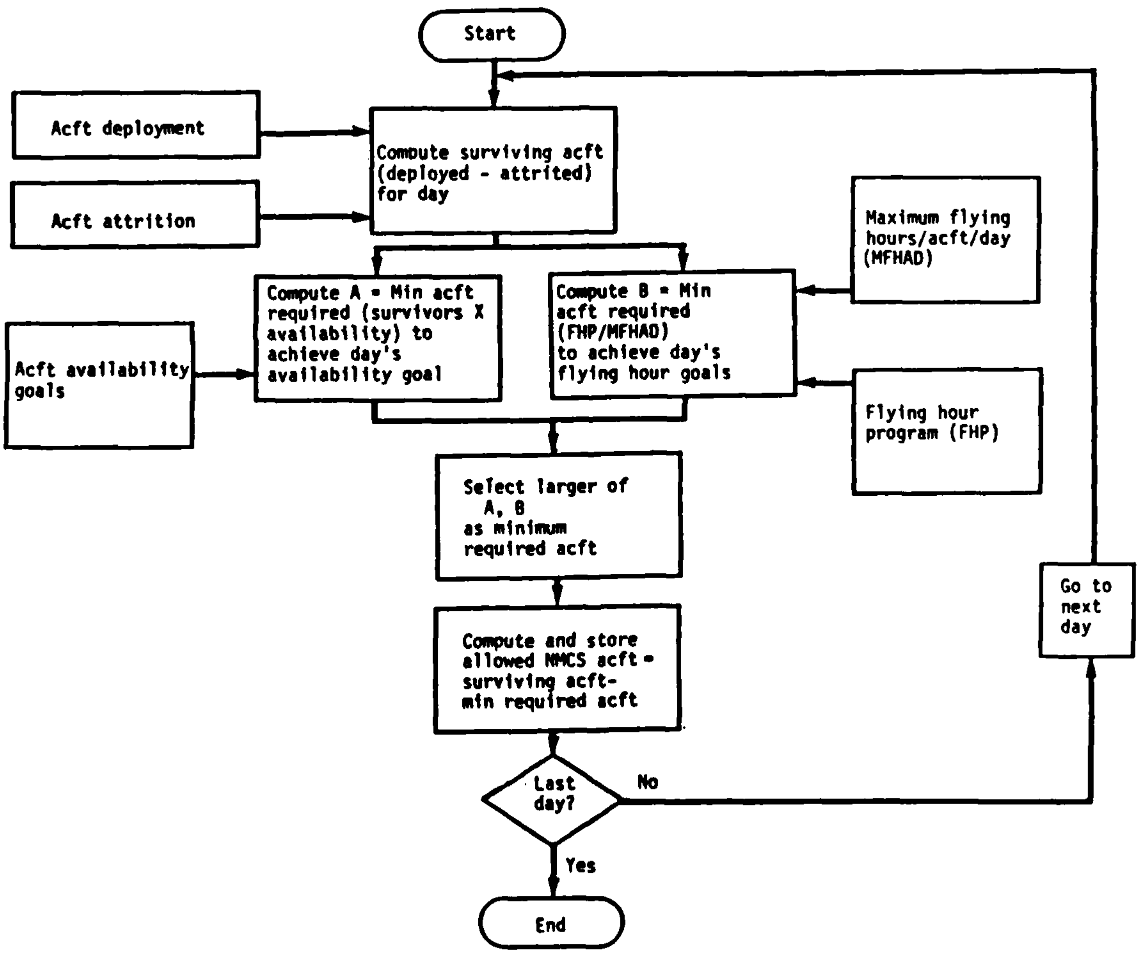


Figure 2-2. Extended PARCOM Computation Algorithm for Allowable NMCS Aircraft

**2-3. UNCONSTRAINED COST REQUIREMENTS ALGORITHM IN BASIC PARCOM.** Extended PARCOM uses the requirements algorithmn of basic PARCOM as a step in its unconstrained cost calculation. Therefore, the logic of that predecessor program is detailed below. Recall that basic PARCOM only processed a full-substitution replacement policy and a no-substitution replacement policy. (The "NMCS = 0" policy is just a special case of no substitution.) The calculation of allowable NMCS aircraft (described previously) is the same for both versions of PARCOM.

a. **Unconstrained Cost Full-Substitution Requirement.** Figure 2-3 shows the basic PARCOM algorithm used to compute a requirements solution for three parts replacement policies with unconstrained costs. The difference between full-substitution and no-substitution calculations is in the way that allowed stockouts are calculated. Net demand is the same for each.

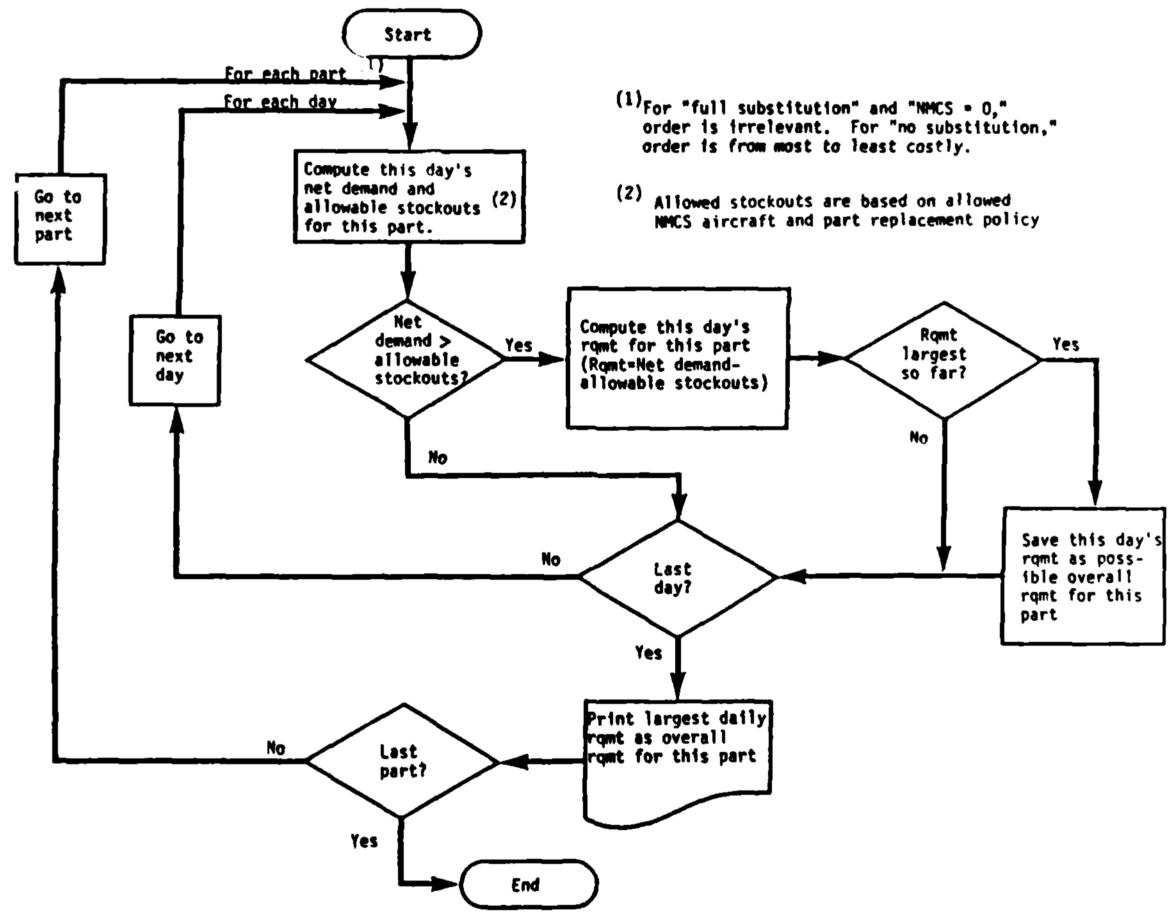


Figure 2-3. Basic PARCOM Requirements Computation Algorithm for Unconstrained Costs, "Full Substitution," "No Substitution," and "NMCS = 0"

**(1)** Net demand (for all three replacement policies) for a part at any point in time is the cumulative removals through that time minus the sum of cumulative returning repairs and issued inventory. Removals are generated as the product of failure rate, part QPA (quantity installed per aircraft), and programed fleet flying hours. Returning repairs are generated by having removed parts cycled through a "repair pipeline" and being returned to the theater spare pool. A positive net demand represents a shortage of a part.

**(2)** Under full substitution, the aircraft frames providing the sources of parts substituted for failed parts when spares unavailable are consolidated to the minimum possible number, i.e., there will be a maximum overlap of aircraft frames providing missing parts. Because of this overlap, the spare parts requirements for each part may be independently computed. For a full-substitution policy, the allowable stockout for a part on any day is the product of allowable NMCS aircraft for that day and the part QPA.

**(3)** As indicated by Figure 2-3, the minimum spare requirement for a part needed to achieve the case objective on any day is the net demand for that part minus the allowable stockout. The overall spare requirement for a part is the largest of the daily minimum spare requirements for that part. It is a least-cost solution because it is the smallest purchase of that part which will permit the case objective to be met on all days.

**b. Unconstrained Cost "NMCS = 0" Requirement.** The "NMCS = 0" policy corresponds to the case in which 100 percent aircraft availability is required every day. In such a case, allowed NMCS aircraft and allowable stockout both must be zero every day. The "NMCS = 0" case could be considered a special case of full substitution with a 100 percent aircraft availability objective (the no-substitution case with that objective would yield the same answer, because substitution policy is irrelevant when no stockouts are allowed). The spares required by the solution to the "NMCS = 0" case also can be interpreted as the total expected net demand for a part during the war. It is a least-cost solution because any amount less than that required to meet the expected demand will create an NMCS aircraft, i.e., will not meet the case objective.

**c. Unconstrained Cost No-Substitution Requirement**

**(1)** Under no substitution, the stockouts generated by parts removals in excess of on-hand spares must each be associated with separate aircraft frames. Every missing part results in an inoperable (NMCS) aircraft. It is most cost effective, therefore, to assign the allowed stockout (allowed number of NMCS aircraft) to the most expensive parts. For example, if 50 aircraft are allowed to be NMCS and a shortage exists of 50 expensive parts and 50 cheap ones, the 50 cheap ones need to be bought. If 75 expensive parts and 50 cheap ones are short, there will be no choice but to buy 25 expensive ones (leaving 50 unbought) and 50 cheap ones, in order to best meet the case objective.

(2) The algorithm of Figure 2-3 also applies to the no-substitution and "NMCS = 0" requirements. Under no substitution, an allowed stockout equates to an allowed NMCS aircraft; and the total allowed stockout, over all parts, equals the total allowed NMCS aircraft for that day. However, allowed stockout calculations for individual parts are interdependent, i.e., the calculations for the first part affect those of the second, etc. The interdependence occurs because there is no overlap/consolidation of stockout effects (as was the case for full substitution). During the no-substitution calculations, basic PARCOM determines allowed stockout and net demand in decreasing order of part unit cost, i.e., for the most expensive parts first. The aspects of algorithm operation affected by differences in substitution policy are summarized in Table 2-1.

**Table 2-1. Differences in Application of Basic PARCOM Unconstrained Cost Requirements Algorithm by Policy**

| | Algorithm procedure/calculation | |
|---|---|---|
| **Policy** | **Allowable stockout** | **Order of processing** |
| Full-sub | Allowed NMCS acft x QPA | Irrelevant |
| No-sub | Allowed NMCS acft | By decreasing part cost |
| NMCS = 0 | 0 | Irrelevant |

## 2-4. UNCONSTRAINED COST REQUIREMENTS ALGORITHM IN EXTENDED PARCOM

**a. Partial-substitution Concept Definition.** Prior to describing the requirements calculation algorithms, it is important to describe the specific representation of a partial-substitution replacement policy in Extended PARCOM. A partial-substitution parts replacement policy is defined by a user-specified partitioning of all part types into a full-sub set and a no-sub set. A part type is in only one set and remains in that set throughout the scenario. These sets are defined as follows:

(1) All parts in the full-sub set operate with a full-substitution replacement policy relative to aircraft which are NMCS due to lack of a part from that set. That is, a failed full-sub part on an aircraft may be replaced either by a spare (if available) or by a serviceable part installed on an NMCS aircraft which is awaiting a full-sub part, if a spare is not available. However, no failed full-sub part can be replaced by any part installed on an NMCS aircraft awaiting a no-sub part.

**(2)** Parts in the no-sub set operate with a no-substitution replacement policy. That is, a failed no-sub part on an aircraft may only be replaced by a spare part. An NMCS aircraft lacking a no-sub part may neither receive a serviceable part from another NMCS aircraft, nor may it provide a serviceable part to (fill a "hole") in any other NMCS aircraft.

**b. Selection of Full-sub Parts.** Before requirements processing begins in Extended PARCOM, a full-sub and a no-sub part set, applicable over all scenario days, must be defined. One option allows the user to specify those part types which comprise the full-sub set. By default, all non-specified parts are presumed to be in the no-sub set. However, the model has another option, allowing the user to specify four screening limits--L1, L2, L3, and L4. With these limits, the model selects a part type for the full-sub set if at least one of the following apply:

- The (input) depot repair cycle time for the part exceeds L1 days, and the not repairable this station (NRTS) fraction exceeds zero.
- The (input) NRTS fraction for the part exceeds L2.
- The (input) retail repair time for the part exceeds L3.
- The (input) failure rate for the part exceeds L4.

**c. Partial-substitution Algorithm Logic.** Figure 2-4 shows the sequence of processing in Extended PARCOM for unconstrained cost requirements. The sequence of operations is:

**(1)** Partition all part types into a full-sub set and a no-sub set as defined in paragraph 2-4a.

**(2)** Calculate the allowable NMCS aircraft for each day.

**(3)** For each day:

**(a)** Generate all possible nonnegative integer combinations (AF, AN) (for full-sub and no-sub, respectively) such that AF + AN = allowable NMCS aircraft for that day.

**(b)** For each integer combination (AF, AN), compute a basic PARCOM full-sub solution **over only the full-sub part set** for the scenario through that day, assuming AF allowed NMCS aircraft (awaiting full-sub parts) for that day. Also compute a basic PARCOM no-sub solution over **only the no-sub part set** for the scenario through that day, assuming AN allowed NMCS aircraft (awaiting no-sub parts) for that day. Calculate the total solution cost for the combination (AF, AN) as the sum of the costs for the full-sub and no-sub solutions described above.

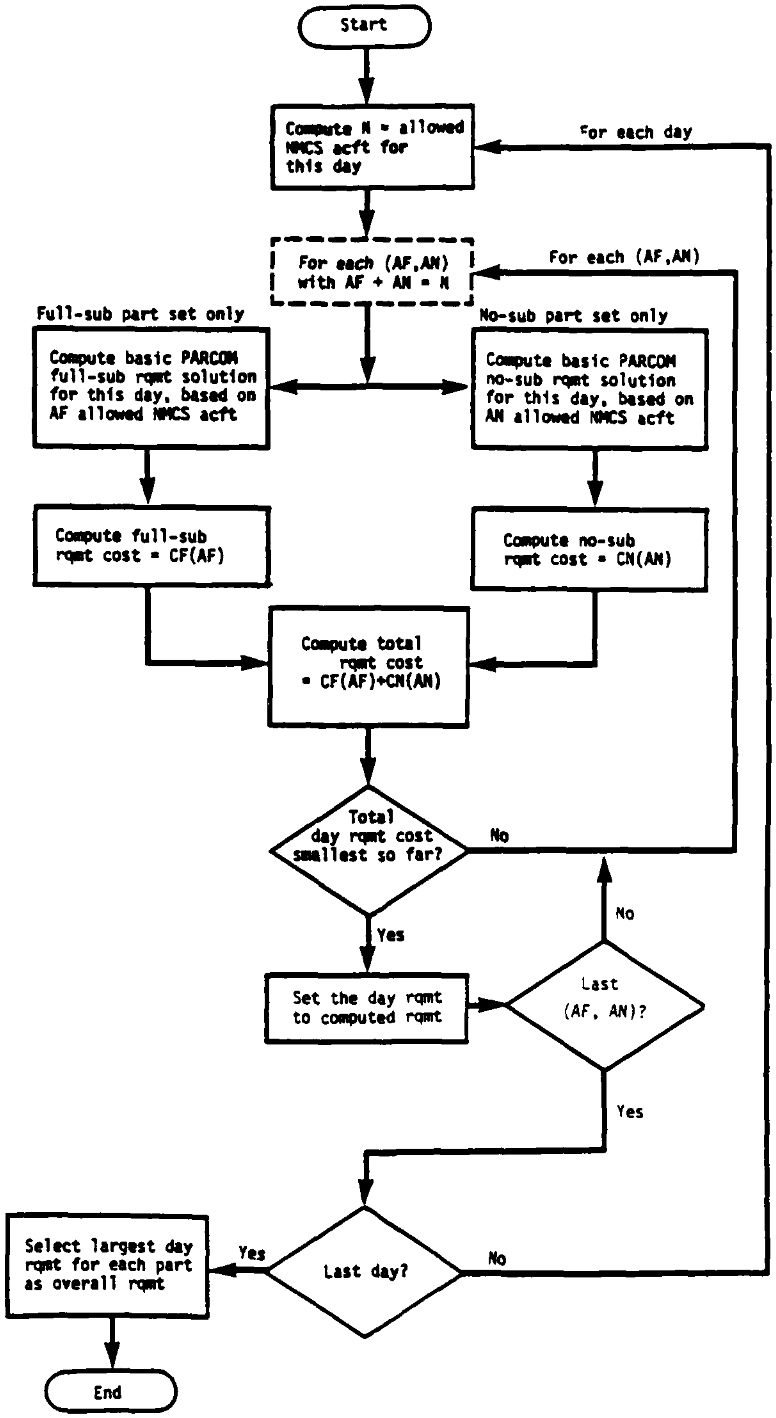


Figure 2-4. Extended PARCOM Requirements Computation Algorithm for Unconstrained Cost, Partial Substitution

**(c)** Select the solution for the combination (AF, AN) yielding the **minimum** total solution cost. This solution determines the requirements for each part on that day and is called the day requirement. The combination (AF, AN) used in the selected solution then becomes the allowed stockout used during cumulative (from Day 1) calculations on all succeeding scenario days.

**(4)** After all days are processed, select the largest (over all scenario days) of the computed day requirements for each part as the overall requirement. The logic for computing a basic PARCOM solution is described in paragraph 2-3. The above algorithm tends toward a least-cost solution mix (assuming unconstrained funds) for the partial-substitution replacement policy defined by the full-sub/no-sub partition of the part data base.

**2-5. CONSTRAINED COST REQUIREMENTS ALGORITHM IN BASIC PARCOM.** While the unconstrained cost solution is the one that best meets the flying program, a full requirements buy may not be affordable if funds are limited. With constrained costs, a user wishes to apply limited funds to buy a cost-effective slice of the full requirements. Basic PARCOM only treated the constrained cost case for a no-substitution policy. Neither full substitution nor partial substitution were addressed. Extended PARCOM incorporates a method for deriving cost-effective constrained cost requirements under partial substitution. For a no-substitution policy, the Extended PARCOM constrained cost algorithm yields the same solution as the basic PARCOM constrained cost algorithm. Since the Extended PARCOM algorithm uses the constrained cost algorithm of basic PARCOM at one stage of its computation, foundation logic from that predecessor model is presented first. In basic PARCOM after the unconstrained cost no-substitution requirements are computed, they become the basis for the constrained cost solution. A cost limit on spares is input along with the other scenario and objective data. A constrained cost parts mix can be constructed by the simulated purchase, in order of increasing part unit cost, of the part requirements for the unconstrained cost solution until the available funds are exhausted. That would entail the procurement, within the fund limit, of the largest possible number of affordable parts from the unconstrained cost solution. However, another characteristic of such a constrained cost parts mix is that it is the mix which has the fewest unbought (hence, unstocked) items from the unconstrained cost solution. The basic PARCOM algorithm, shown in Figure 2-5, arrives at its solution by calculating unbought items. Initially, it "spends" the full cost of the unconstrained cost requirements mix, assuming it to be the constrained cost solution. Basic PARCOM subsequently selects the fewest number of items to remove from that solution until the remaining parts mix is priced at the input cost limit. Because the programed algorithm solves by "unbuying" items rather than "buying" them, parts are processed in decreasing order of part unit cost. Notice that under a policy of no substitution, each unbought item (regardless of part type) creates an NMCS aircraft. Therefore, our constrained cost solution mix minimizes the instances of NMCS created by the constrained funds. The solution tends, heuristically, toward the achievement of maximum cumulative flying hours.

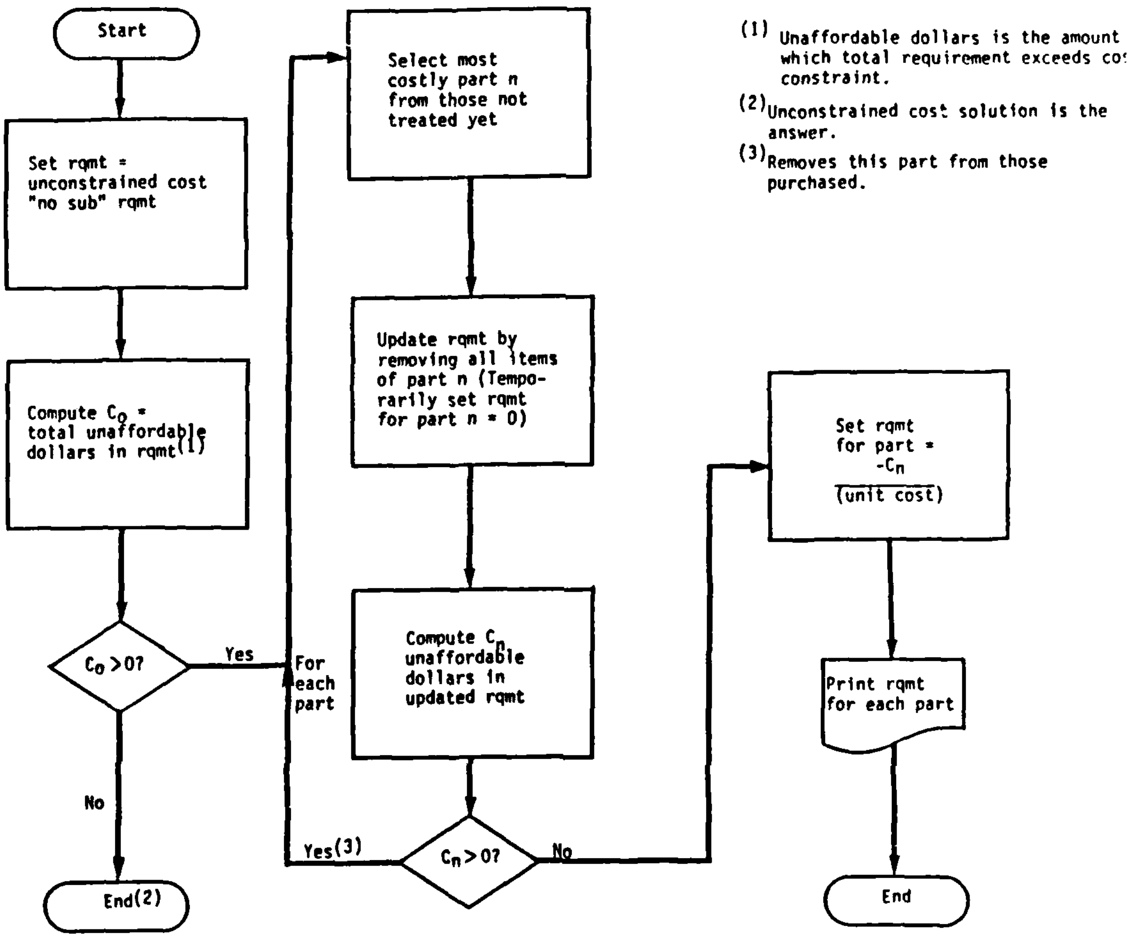


Figure 2-5. Basic PARCOM Requirements Computation Algorithm for Constrained Cost with No Substitution

**2-6. CONSTRAINED COST REQUIREMENTS ALGORITHMS IN EXTENDED PARCOM.** Figure 2-6 shows the logic for constrained cost calculations in Extended PARCOM. Since no single algorithm yielding optimum results for all cases was found, the Extended PARCOM logic employs two separate algorithms represented by the branches labeled "algorithm 1" and "algorithm 2" in the figure. These algorithms compute separate trial solutions. Each computed solution is assessed in terms of the fleet program flying hour productivity which it contributes. The trial solution yielding the larger flying hour productivity is selected as the final solution. The component algorithms of Figure 2-6 are explained below.

**a. Constrained Cost Algorithm 1 Solution.** The previously computed unconstrained cost requirements solution is partitioned into the set of requirements for no-sub parts and the set of requirements for full-sub parts. In Figure 2-6, these are denoted as "no-sub part set only" and "full-sub part set only." The "no-sub part set only" is taken as the unconstrained cost no-sub requirement which the basic PARCOM no-substitution constrained cost algorithm (Figure 2-5) operates on, using the input-specified cost limit (LIM in Figure 2-6), to yield a cost effective solution mix of no-sub parts. From this procedure, there are two possible outcomes: either the entire cost limit is spent, or only a portion of the cost limit is spent. Each outcome yields a different algorithm 1 solution as follows:

(1) In the first outcome, the basic PARCOM solution mix cost, C, equals the cost limit. That mix of no-sub parts is then taken as the algorithm 1 solution.

(2) In the second case, the cost of the basic PARCOM solution mix will be less than the cost limit. That solution mix is then assumed bought, and its associated cost, C, is assumed spent. The unspent portion, FLIM, of the cost limit is then calculated. Computation of the algorithm 1 solution then continues by using the FLIM dollars to buy the most cost-effective portion of the "full-sub part set only," as follows:

(a) One product of the Extended PARCOM unconstrained cost solution is a list showing, for each day, the cumulative total cost of all full-sub parts in the unconstrained cost requirement for the scenario truncated at that day. Algorithm 1 determines D, the last day for which the associated cumulative requirement cost of full-sub parts is less than or equal to the unspent funds, FLIM.

(b) Next, algorithm 1 generates an Extended PARCOM unconstrained cost solution for the scenario truncated at that day. The full-sub parts required in that solution are denoted in Figure 2-6 as the "constrained cost requirements solution for full substitution." These full-sub parts are combined with the no-sub solution mix previously bought to form the full algorithm 1 solution for the second case.

**b. Constrained Cost Algorithm 2 Solution.** Figure 2-7 shows the logic of algorithm 2. One product of the Extended PARCOM unconstrained cost solution is a list showing, for each scenario day, the cumulative cost of all parts (full-sub and no-sub) that would be required under unconstrained cost if the war was truncated at that day. The algorithm determines D, the last day on that list, for which the associated cost is less than or equal to the input cost limit. Next, the algorithm operates Extended PARCOM in the unconstrained cost mode for a scenario of length D. The resulting (unconstrained cost) solution is taken as the algorithm 2 solution.

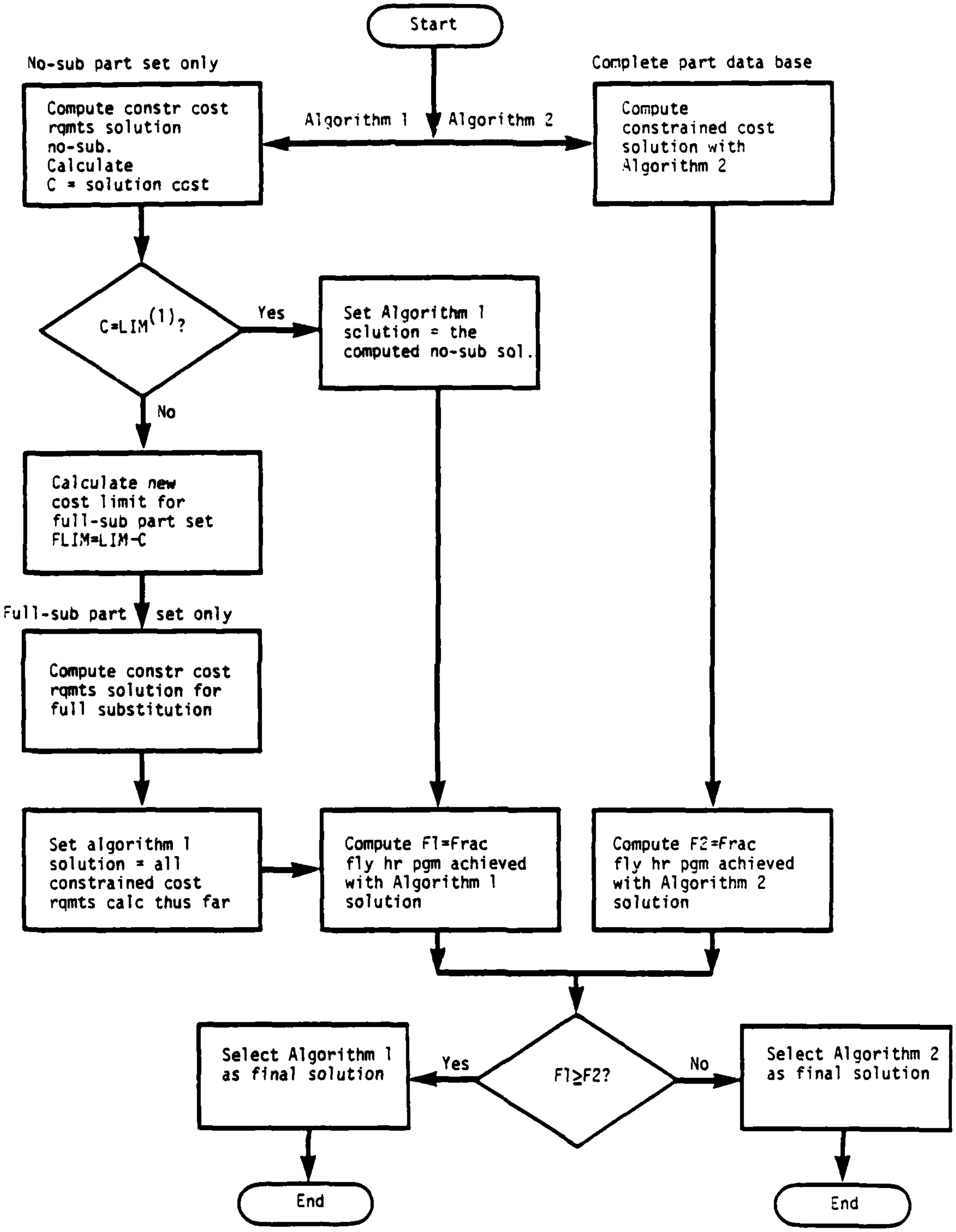


**Figure 2-6. Extended PARCOM Requirements Computation Algorithm for Constrained Cost with Partial Substitution**

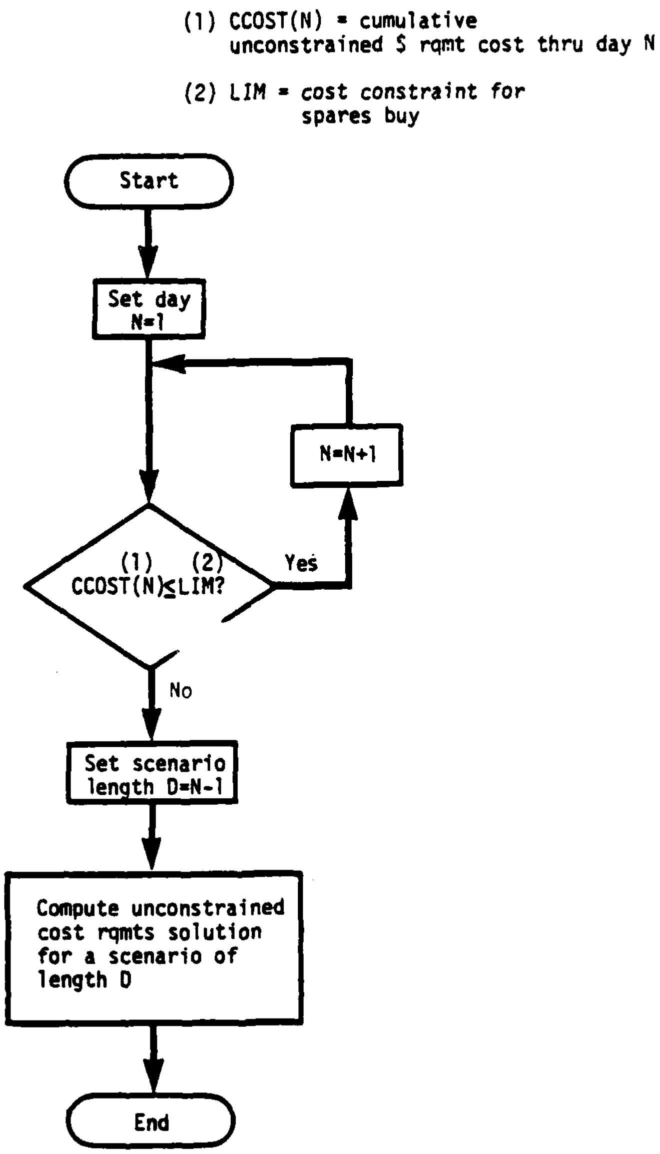


Figure 2-7. Extended PARCOM Constrained Cost Algorithm 2

c. **Solution Selection.** The preferred solution mix, of those generated by the two algorithms, is the one which yields the maximum program flying hour productivity in the scenario. The model, therefore, does two separate current inventory capability assessments based on each algorithm solution being bought and stocked. The add-on solution requirement is assumed to be added to the theater war reserve. The final constrained cost solution is the one for which the associated capability assessment yields the larger value for average fraction of total flying hour program achieved (F1 or F2 in Figure 2-6).

**2-7. CAPABILITY ASSESSMENT OF UNCONSTRAINED COST SOLUTIONS.** Figure 2-8 illustrates the Extended PARCOM computation algorithm for capability assessment of the unconstrained cost requirements solutions. After an unconstrained cost solution mix is computed, Extended PARCOM generates a record of daily and average fleet operational capability achievable by stocking each computed requirement in the war reserve, i.e., the new initial inventory is assumed to be the sum of the computed requirement and the original initial inventory. For each computed unconstrained cost requirements mix, the model generates a record of achieved daily and average aircraft availability and achieved flying hours per available aircraft per day. The achieved program flying hours are simply the desired program flying hours, by the definition of an unconstrained cost solution. Within the algorithm, each day's calculations consist of a full-sub assessment phase and a no-sub assessment phase, followed by a consolidated computation. Each full-sub phase treats only NMCS aircraft created by stockouts of full-sub parts. For a full-substitution policy, a single NMCS aircraft may have demands for several different parts. In this case, the total number of NMCS aircraft created is the largest value, over all full-sub parts, of the quotient of net demand divided by QPA for each full-sub part type. The no-sub phase treats only NMCS aircraft created by stockouts of no-sub parts. For a no-substitution policy, each net demand creates a single NMCS aircraft. In this case, the total number of NMCS aircraft created is the sum of net demand over all no-sub parts. At the end of daily processing, the consolidated total NMCS aircraft for the day is calculated as the sum of the NMCS aircraft results from the two phases. Under our definition of partial substitution, each NMCS aircraft is down due to either at least one needed full-sub part or to a single needed no-sub part, but not to a needed combination of the two types. Therefore, the order of performing the phases is irrelevant. For each day, the number of NMCS aircraft is subtracted from the number of surviving aircraft to yield available aircraft. Availability is then the ratio of available to surviving aircraft. Flying hours per available aircraft is just the daily program flying hours divided by the number of available aircraft for the day.

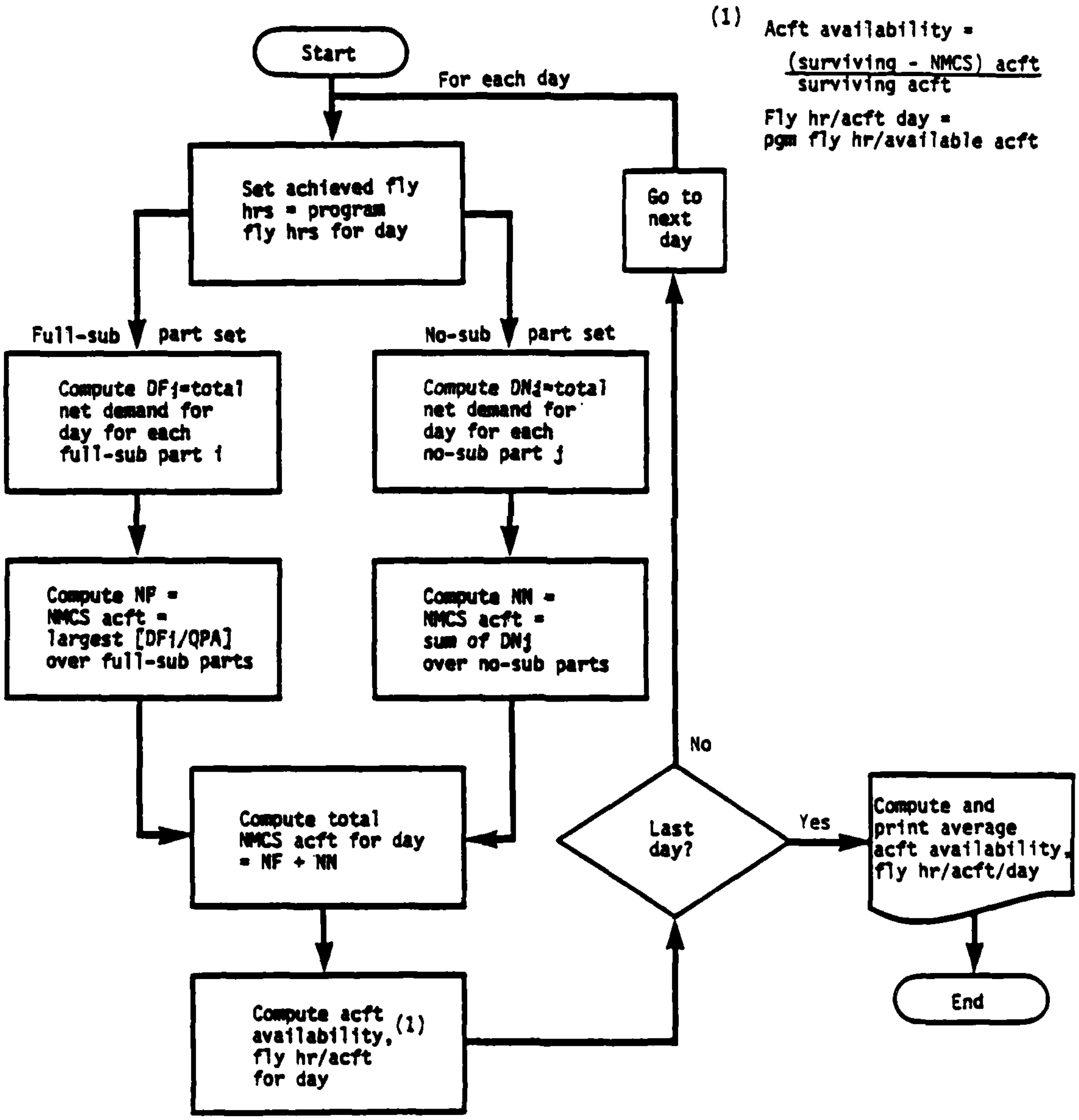


Figure 2-8. Extended PARCOM Computation Algorithm for Unconstrained Cost Capability Assessment

**2-8. CAPABILITY ASSESSMENT OF CONSTRAINED COST SOLUTION MIXES.** Extended PARCOM also generates the daily fleet availability and flying hour capability achieved with a constrained cost solution mix or with current inventory. Computation logic is shown in Figure 2-9. By current inventory is meant any user-specified inventory (with an add-on cost constraint of zero). This is in contrast to the "required inventory" as assessed above. The basic logic of assessment of current inventory in Extended PARCOM is the same as in the basic PARCOM. With unconstrained cost, net demand was based on the entire planned flying hour program being flown. For a constrained cost or current inventory mix, some unknown (at first) number of hours will be flown. That number must initially be estimated; and an iterative approach, as shown in Figure 2-9, applied to determine NMCS aircraft, availability, and achievable program flying hours. For each day, therefore, a starting estimate of flying hours flown is made. The starting (first day's) estimate is the desired program flying hours. Then, net demand, as based on the estimated flying hours, is computed, followed by computation of implied NMCS aircraft (generated by the estimated flying hours), achievable flying hours (based on aircraft available if implied NMCS aircraft are really NMCS), and flying hours per available aircraft. The achievable flying hours are compared with the estimated flying hours flown. If, based on input thresholds, they are close enough, the iterations stop. Iterations also stop after an input-specified number of them have been performed. If iterations continue, the calculations are repeated based on a new starting estimate of flying hours equal to the average of the estimated and the achieved flying hours. After iterations for a day are completed, the available aircraft for the day and their flying hour potential are calculated based on the last calculation of NMCS aircraft and on the maximum flying hour potential per aircraft per day (an input). Processing for the next day uses a starting estimate of flying hours equal to the program flying hours for that day or the flying hour potential of the surviving non-NMCS aircraft on that day, whichever is smaller.

**2-9. EXAMPLE.** The algorithm logic described in the previous paragraphs can be better understood through use of a manual example. The tables to follow portray a stylized but useful hypothetical example which utilizes only "back-of-the envelope" calculations. The tables all apply to one case and are presented in the same sequence as the model algorithms described in the previous paragraph.

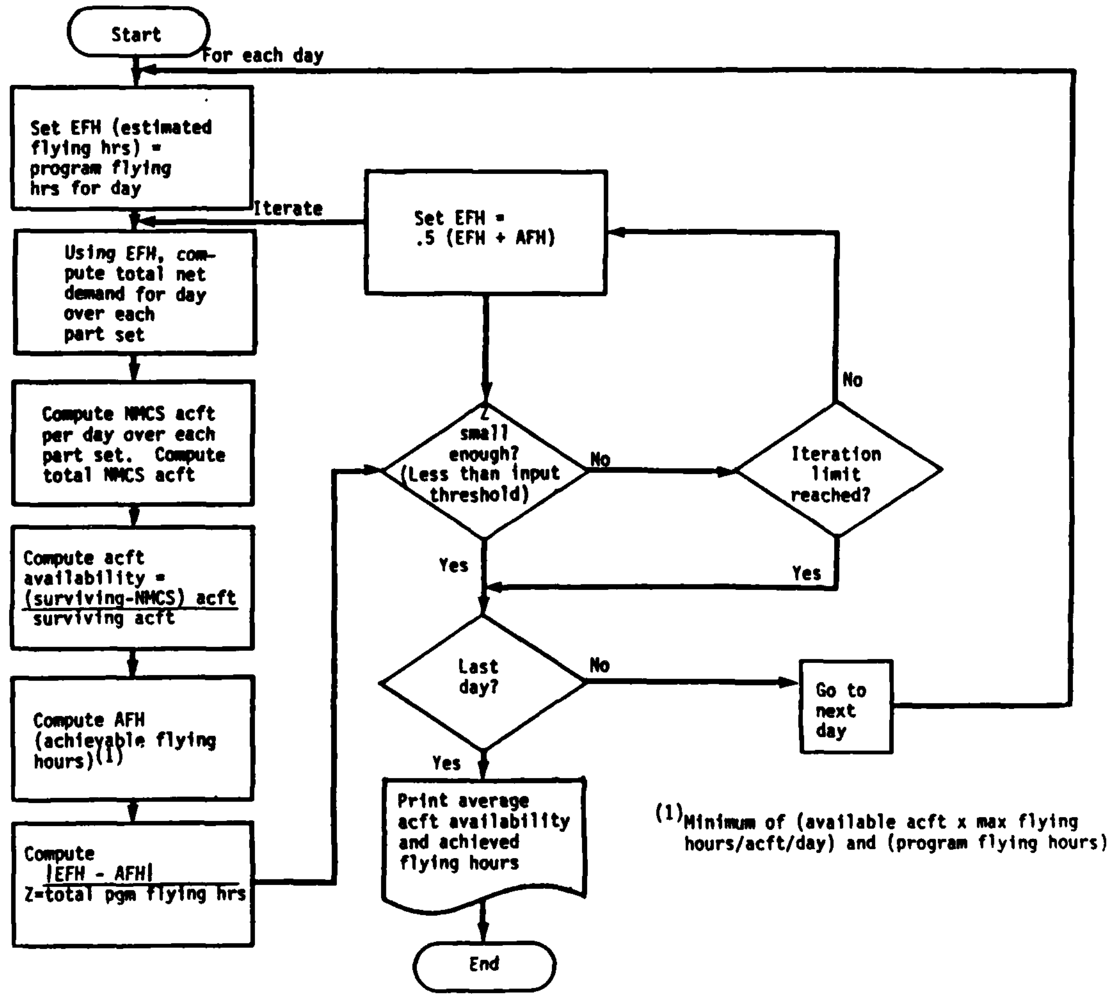


**Figure 2-9. Extended PARCOM Computation Algorithm for Constrained Cost/Current Inventory Capability Assessment**

a. **Parts Data Base.** Tables 2-2 through 2-4 show a parts data base for four part types. Recall that failure rate is in terms of failures per flying hour, and QPA = number of parts installed per operational aircraft. The last column of Table 2-4 is the computed repair cycle calculated from the other data in that row; e.g., for Part 1 the repair cycle = 2 x OST + depot repair time = 3 days. The repair cycle for a part is defined as the average time between failure of a part and its (repaired) return to the retail spare pool. Only the repair cycle entry will be used in succeeding calculations because it includes the effects of the other data in Table 2-4.

Table 2-2. Part Characteristic Data

| Part | Failure rate (per fly hour) | QPA | Unit cost ($) | Substitution class |
|---|---|---|---|---|
| 1 | .08 | 1 | 40 | Full-sub |
| 2 | .02 | 1 | 50 | Full-sub |
| 3 | .06 | 1 | 400 | No-sub |
| 4 | .02 | 1 | 30 | No-sub |

Table 2-3. Initial Stock Distribution Data

| Part | In-place Day 1 | Addition to initial stock | | | | Total initial stock |
|---|---|---|---|---|---|---|
| | | Day 2 | Day 3 | Day 4 | Day 5 | |
| 1 | 90 | 40 | 40 | 40 | 40 | 250 |
| 2 | 6 | 1 | 1 | 1 | 1 | 10 |
| 3 | 220 | 10 | 10 | 10 | 10 | 260 |
| 4 | 30 | 0 | 0 | 0 | 0 | 30 |

Table 2-4. Part Repair Time Data

| Part | OST (days) | Depot repair time (days) | Retail repair time (days) | NRTS (fraction) | Depot condemned (fraction) | Retail condemned (fraction) | Repair cycle (days) |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 1.00 | 0 | 0 | 3 |
| 2 | 0 | 0 | 3 | .00 | 0 | 0 | 3 |
| 3 | 1 | 2 | 0 | 1.00 | 0 | 0 | 4 |
| 4 | 0 | 0 | 2 | .00 | 0 | 0 | 2 |

**b. Definition of Policy.** As noted in Table 2-2, Part 1 and Part 2 are designated for the full-sub set while Part 3 and Part 4 comprise the no-sub part set.

**c. Scenario Data Base.** Table 2-5 shows the scenario data for the case. A 5-day "war" is shown. The aircraft status (deployed, lost) entries are for the start of the associated day of the war. Thus, for example, 50 aircraft are newly deployed at the start of day 2. By "cumulative aircraft deployed" is meant all aircraft deployed in theater from the start of the war through the given day. No aircraft are assumed withdrawn once deployed. Computed "cumulative aircraft surviving" entries are defined by the difference between "cumulative aircraft deployed" and "cumulative aircraft lost." Since, for simplicity, our example shows a zero aircraft attrition rate, surviving aircraft are equal to deployed aircraft. The "program flying hours" column gives the flying hour objective in terms of required program flying hours for the fleet on each day. The last column gives the availability objective in terms of an input-specified daily minimum (fleet) aircraft availability required each day. The input-specified "maximum flying hours per aircraft per day" is also noted at the bottom of Table 2-5.

**Table 2-5. Scenario Data**

| Day | Cumulative aircraft deployed | Cumulative aircraft lost | Cumulative aircraft surviving | Program flying hours | Minimum aircraft availability |
|---|---|---|---|---|---|
| 1 | 150 | 0 | 150 | 500 | .10 |
| 2 | 200 | 0 | 200 | 1,000 | .09 |
| 3 | 200 | 0 | 200 | 1,000 | .09 |
| 4 | 200 | 0 | 200 | 1,500 | .09 |
| 5 | 200 | 0 | 200 | 1,500 | .09 |

Maximum flying hours per aircraft per day = 10.

Cost limit for constrained cost case = $2,300.

Desired convergence (constrained cost) = 0.

Maximum iterations (constrained cost) = 2.

**d. Calculation of Daily Allowable NMCS Aircraft.** Table 2-6 shows results of the calculation of allowable NMCS aircraft for each day. Each result in the rightmost column is the surviving aircraft minus the larger of:

**(1)** The minimum aircraft required to achieve the daily flying hour objective, for each day, computed as "program flying hours" divided by "maximum flying hours per aircraft per day."

**(2)** The minimum aircraft required to achieve the daily availability objective, for each day, computed as the product of "surviving aircraft" and "minimum aircraft availability." Component calculations for the first day, using the data of Table 2-5, are shown.

**Table 2-6. Calculation of Allowable NMCS Aircraft**

| Day | Minimum aircraft required | | Allowable NMCS acft |
|---|---|---|---|
| | Flying hour objective | Availability objective | |
| 1 | 500/10 = 50 | 150*.10 = 15 | 150-50 = 100 |
| 2 | 100 | 18 | 100 |
| 3 | 100 | 18 | 100 |
| 4 | 150 | 18 | 50 |
| 5 | 150 | 18 | 50 |

**e. Unconstrained Cost Residual Requirement.** The full set of algorithmic calculations is too complex to represent. The Extended PARCOM algorithm consists of calculation and cost comparison of a large number of basic PARCOM full-substitution and no-substitution solutions using the full-sub and the no-sub part sets, respectively. However, two of these solutions for one value of AF and the consequent values of AN (see Figure 2-4) which serve as the base of the Extended PARCOM solution are illustrated below.

(1) The full-sub solution with zero allowed stockouts (AF = 0) is illustrated in Tables 2-7 and 2-8 for those parts in the full-sub set. Each "cumulative net demand" entry is just the "cumulative failures" minus the sum of the "cumulative returning repairs" and the cumulative initial stock distributed (from Table 2-3). "Cumulative failures" is based on the program hours being flown and is computed by accumulating (over days) the product of failure rate, QPA, and program flying hours for each day (as taken from Tables 2-2 and 2-5). The "cumulative returning repairs" entries are the "cumulative failures" entries lagged by 3 days (the repair cycle from Table 2-4). Any condemnations (our case has none) would have to be deducted from the lagged failures. If R is the length of the repair cycle for a part (see Table 2-4), Extended PARCOM treats all noncondemned failures occurring by the start of day n as being returned to the retail spare pool at the start of day *n* + R. If a part has both a depot repair cycle and a retail repair cycle, Extended PARCOM would partition repairs over the two cycles. In our simplified example, Part 1 has only a depot repair cycle of 3 days while Part 2 has only a retail repair cycle of 3 days. The "day requirement" is calculated as the larger of zero and (cumulative net demand minus allowable stockouts). Since this case has a zero allowed stockout, the day requirement is equal to the cumulative net demand. The overall requirement for each part is determined as the largest value (over days) of the "day requirement" entries. It is circled in each table. Component calculations are based on the data of Tables 2-2 through 2-6 and are shown for the first day and, partly, for the last day. Because allowed stockouts = 0 for this case, the solution shown is also an "NMCS = 0" solution in basic PARCOM.

**Table 2-7. Unconstrained Cost Residual Requirement with Full-Substitution, Allowed Stockouts = 0 (Part 1)**

| Day | Cumulative failures | Cumulative returning repairs | Cumulative initial stk distributed | Cumulative net demand (= day rqmt) |
|---|---|---|---|---|
| 1 | .08*500=40 | 0 | 90 | max (0,40-90) = 0 |
| 2 | 120 | 0 | 130 | 0 |
| 3 | 200 | 0 | 170 | 30 |
| 4 | 320 | 40 | 210 | 70 |
| 5 | 440 | 120 | 250 | 440-370 = 70 |

**Table 2-8. Unconstrained Cost Residual Requirement with Full Substitution, Allowed Stockouts = 0 (Part 2)**

| Day | Cumulative failures | Cumulative returning repairs | Cumulative initial stk distributed | Cumulative net demand (= day rqmt) |
|---|---|---|---|---|
| 1 | .02*500=10 | 0 | 6 | max (0, 10-6) = 4 |
| 2 | 30 | 0 | 7 | 23 |
| 3 | 50 | 0 | 8 | 42 |
| 4 | 80 | 10 | 9 | 61 |
| 5 | 110 | 30 | 10 | 110-40 = 70 |

(2) The no-sub solution from basic PARCOM is shown in Tables 2-9 and 2-10 for those parts in the no-sub set. The tables are presented in the required sequence of computations, i.e., the more expensive no-sub part (Part 3) is processed first. The "cumulative net demand" is computed in the same way as for Part 1 and Part 2 above. The day requirement is just the cumulative net demand (the shortage on that day) minus the allowable stockout (the allowed shortage) for that day (but not less than zero). Under no substitution, daily allowed stockout is equal to daily allowable NMCS aircraft (computed in Table 2-6). The overall Part 3 requirement is the circled largest day requirement. The Part 3 requirement is treated as "purchased" during further processing (for other no-sub part requirements). Table 2-10 shows the calculation of the next no-sub part requirement which must be for the next most expensive no-sub part (i.e., Part 4 in our example). The purchase of the Part 3 requirement augments the initial inventory for that part. Therefore, the old cumulative net demand for Part 3 in Table 2-9 is reduced by the purchased requirement for that part to generate the new cumulative net demand for that part. Since the computed requirement was zero, the new cumulative net demand for Part 3 equals the old cumulative net demand in this example. The new cumulative net demand for Part 3 is also the number of stockouts which **must** be allocated to that part. For a no-substitution policy, the total allowed stockout consists of the summed stockouts over all parts treated. For each day, the cumulative net demand for Part 3 acts as a "lock" or "claimant" on the same number of stockouts in the original allowable stockout. Requirements for Part 4 can only be based on the unallocated allowable stockout, tabulated in Table 2-10, which is the original allowed stockout minus all "claimant" stockouts (net demands) from parts already processed (from Part 3 in this example). Since the Part 4 requirement is not yet "purchased" (it is being computed), the cumulative net demand entries for Part 4 in Table 2-10 are computed in the same manner as in Tables 2-7 and 2-8, using the initial stock distribution of Table 2-3. The day requirement in Table 2-10 is calculated as the cumulative net demand for Part 4 minus the unallocated allowable stockout.

As before, the overall requirement (circled) is the largest of the day requirements. The Part 4 requirement would be assumed purchased, and the process would be continued with less expensive no-sub parts (if any). Each successive calculation would use an unallocated allowable stockout equal to the original allowable stockout reduced by the sum total of allocated stockouts reflected in purchases of parts already processed.

**Table 2-9. Unconstrained Cost Residual Requirement with No Substitution (Part 3)**

| Day | Cum failures | Cum return repairs | Cum init stock | Cum net demand | Allowed stockout | Day rqmt |
|---|---|---|---|---|---|---|
| 1 | 30 | 0 | 220 | 0 | 100 | 0 |
| 2 | 90 | 0 | 230 | 0 | 100 | 0 |
| 3 | 150 | 0 | 240 | 0 | 100 | 0 |
| 4 | 240 | 0 | 250 | 0 | 50 | 0 |
| 5 | 330 | 30 | 260 | 40 | 50 | 0 |

**Table 2-10. Unconstrained Cost Residual Requirement with No Substitution (Part 4)**

| Day | Part 3 (new cum net demand) | Cumulative net demand (Part 4) | Unallocated allowable stockouts | Day rqmt |
|---|---|---|---|---|
| 1 | 0 | 0 | 100-0 = 100 | 0 |
| 2 | 0 | 0 | 100-0 = 100 | 0 |
| 3 | 0 | 10 | 100-0 = 100 | 0 |
| 4 | 0 | 20 | 50-0 = 50 | 0 |
| 5 | 40-0 = 40 | 30 | 50-40 = 10 | 30-10 = 20 |

**(3)** After the above solutions are computed, they become the basis for the partial-substitution algorithm calculations for Day 5 shown in Table 2-11. The following comments apply:

**(a)** To simplify computations, the only combinations (AF, AN) shown are multiples of 10. Since, from Table 2-6, total allowed NMCS aircraft on Day 5 from all parts must equal 50, the sum of AF and AN in Table 2-11 must be 50.

**(b)** For AF = 0 on Day 5, the solution for the full-sub part set is 70 for Part 1 and 70 for Part 2 (Tables 2-7 and 2-8, respectively). These are also the requirements for these parts under an "NMCS = 0" policy in basic PARCOM.

**(c)** For values of AF greater than 0, solutions for the full-sub parts set are obtained by subtracting AF x QPA (= AF since QPA = 1 in this example) units from each part requirement in the "AF = 0" solution (since each reduction of parts stock by its QPA units creates QPA backorders which, in turn, correspond to one NMCS aircraft).

**(d)** The no-sub solution for AN (allowed NMCS aircraft for the no-sub set) = 50 on Day 5 is computed in Tables 2-9 and 2-10. For AN less than 50, a no-sub solution is obtained, as seen in Table 2-11, by adding (50 -AN) units to the computed stock requirement for the cheapest item(s) in the "AN = 50" solution in the following manner. Units are added first to the computed requirement for the cheapest part, up to the level of cumulative net demand for that part, after which further units are added to the computed requirement for the next cheapest part, in the same manner. Using this technique, each increase of one unit eliminates a backorder and corresponds to one less NMCS aircraft.

**(e)** The minimum combined (total) solution cost ($6,300) is marked in Table 2-11. The combined parts requirement for the associated (AF, AN) combination is the day requirement for Day 5. If (as assumed in this example) Day 5 has the largest day requirement, then that day requirement is also the overall minimum cost solution for our partial-substitution example.

**Table 2-11. Unconstrained Cost Residual Requirement Calculations for Day 5**

| Combined solution | AF | Full-sub solution pt 1/pt 2 $40/$50 | Cost ($) | AN | No-sub solution pt 3/pt 4 $400/$30 | Cost ($) | Combined solution cost ($) |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 70/70 | 6,300 | 50 | 0/20 | 600 | 6,900 |
| 2 | 10 | 60/60 | 5,400 | 40 | 0/30 | 900 | 6,300 |
| 3 | 20 | 50/50 | 4,500 | 40 | 10/30 | 4,900 | 9,400 |
| 4 | 30 | 40/40 | 3,600 | 20 | 20/30 | 8,900 | 12,500 |
| 5 | 40 | 30/30 | 2,700 | 10 | 30/30 | 12,900 | 15,600 |
| 6 | 50 | 20/20 | 1,800 | 0 | 40/30 | 16,900 | 18,700 |

| Minimum cost solution = | Pt 1 | Pt 2 | Pt 3 | Pt 4 |
|---|---|---|---|---|
| | 60 | 60 | 0 | 30 |

(assuming Day 5 has max day requirement).

**f. Capability Assessment of the Unconstrained Cost Solution.** Tables 2-12a and b shows the Extended PARCOM capability assessment calculation of the effects of stocking the requirements computed in Table 2-11. Each day's calculations entail a full-sub assessment phase and a no-sub assessment phase, operating on the full-sub part set (Parts 1 and 2) and the no-sub part set (Parts 3 and 4), respectively. During the full-sub phase, NMCS aircraft from failed full-sub parts is determined as the larger of the (cumulative net demand/QPA) entries over Parts 1 and 2, where cumulative net demand is based on initial inventory as augmented by the computed requirement from Table 2-11. Therefore, the entries for Parts 1 and 2 consist of the cumulative net demand entries from Tables 2-7 and 2-8 reduced by the value of the computed requirements. During the no-sub phase, NMCS aircraft from failed no-sub parts are determined as the sum of the cumulative net demand entries for Parts 3 and 4, where cumulative net demand is based on initial inventory as augmented by the computed requirements. Under the assumed definition of partial substitution, each NMCS aircraft is "down" due to either at least one needed full-sub part or a single needed no-sub part, but not to a needed combination of the two types. Therefore, the order of performing the phases is irrelevant. On each day, after the two NMCS aircraft calculation phases are completed, the sum of the two results yields the total NMCS aircraft for the day (Table 2-12b). This value divided by surviving aircraft on that day determines the fraction NMCS. Subtracting this fraction NMCS from 1.00 yields aircraft availability for the day. Flying hours per (available) aircraft per day are calculated by dividing the program flying hours for each day (see Table 2-5) by the number of available aircraft on that day. Average availability is constructed by weighting daily availabilities by the daily surviving aircraft. Average flying hours per (available) aircraft per day are weighted by the available aircraft on each day.

**Table 2-12a. Capability Assessment for Unconstrained Cost Residual Requirement[a]**

| Day | Phase[b] | Cum net demand/QPA Part 1 | Cum net demand/QPA Part 2 | Cum net demand Part 3 | Cum net demand Part 4 | NMCS aircraft |
|---|---|---|---|---|---|---|
| 1 | FS | 0 | 0 | -- | -- | 0 |
| | NS | -- | -- | 0 | 0 | 0 |
| 2 | FS | 0 | 0 | -- | -- | 0 |
| | NS | -- | -- | 0 | 0 | 0 |
| 3 | FS | 0 | 0 | -- | -- | 0 |
| | NS | -- | -- | 0 | 0 | 0 |
| 4 | FS | 70-60=10 | 61-60=1 | -- | -- | 10 |
| | NS | -- | -- | 0 | 0 | 0 |
| 5 | FS | 70-60=10 | 0 | -- | -- | 10 |
| | NS | -- | -- | 40 | 0 | 40 |

[a]Residual requirement (60,60,0,30) is added to initial war reserve stock.

[b]FS = Full-sub phase (processes full-sub part set)
NS = No-sub phase (processes no-sub part set)

Table 2-12b. Capability Assessment for Unconstrained Cost Residual Requirement

| Day | Total NMCS aircraft | Surviving aircraft | Aircraft availability | Program flying hours/acft/day |
|---|---|---|---|---|
| 1 | 0 | 150 | 1.00 | 3.3 |
| 2 | 0 | 200 | 1.00 | 5.0 |
| 3 | 0 | 200 | 1.00 | 5.0 |
| 4 | 10+0=10 | 200 | 190/200=.95 | 7.9 |
| 5 | 10+40=50 | 200 | .75 | 10.0 |

Average availability = .94

Average flying hours/aircraft/day = 6.2

**g. Capability Assessment of Current Inventory/Constrained Cost Case.** Since the same algorithm applies to capability assessment of current inventory and of a constrained cost solution, only assessment of current inventory will be detailed here. Tables 2-13a, b, and c show the calculations for this case. As before, calculation of daily NMCS aircraft is done in two phases. Now, however, each phase of each day employs a series of iterative calculations, as explained in paragraph 2-8, beginning with an "estimated flying hours flown" and, based on that estimate, calculating an "achieved flying hours" value. Iterations continue until estimated and achieved flying hours are close together or until a specified number of iterations have been performed. Some essential explanatory comments follow the tables.

Table 2-13a. Capability Assessment of Current Inventory

| Day | Iteration | Phase | Est fly hrs | Cum net dmd/QPA Part 1 | Cum net dmd/QPA Part 2 | Cum net demand Part 3 | Cum net demand Part 4 | NMCS acft |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | FS | 500 | 0 | 4 | -- | -- | 4 |
| | 1 | NS | 500 | -- | -- | 0 | 0 | 0 |
| 2 | 1 | FS | 1,000 | 0 | 23 | -- | -- | 23 |
| | 1 | NS | 1,000 | 0 | -- | 0 | 0 | 0 |
| 3 | 1 | FS | 1,000 | 0 | 42 | -- | -- | 42 |
| | 1 | NS | 1,000 | -- | -- | 0 | 10 | 10 |
| 4 | 1 | FS | 1,500 | 70 | 61 | -- | -- | 70 |
| | 1 | NS | 1,500 | -- | -- | 0 | 20 | 20 |
| | 2 | FS | 1,300 | 54 | 57 | -- | -- | 57 |
| | 2 | NS | 1,300 | -- | -- | 0 | 16 | 16 |
| 5 | 1 | FS | 1,270 | 36 | 61 | -- | -- | 61 |
| | 1 | NS | 1,270 | -- | -- | 14 | 21 | 35 |
| | 2 | FS | 1,165 | 27 | 59 | -- | -- | 59 |
| | 2 | NS | 1,165 | -- | -- | 8 | 19 | 27 |

Table 2-13b. Capability Assessment of Current Inventory

| Day | Iteration | Total NMCS aircraft | Avail aircraft | Achieved flying hrs | (EFH-AFH)/(average day FHP)[a] |
|---|---|---|---|---|---|
| 1 | 1 | 4 | 146 | 500 | 0 |
| 2 | 1 | 23 | 177 | 1,000 | 0 |
| 3 | 1 | 52 | 148 | 1,000 | 0 |
| 4 | 1 | 90 | 110 | 1,100 | .36 |
| | 2 | 73 | 127 | 1,270 | .03 |
| 5 | 1 | 96 | 104 | 1,040 | .21 |
| | 2 | 86 | 114 | 1,140 | .02 |

[a]Average flying hour program (FHP) = 1,100 flying hrs/day.

Table 2-13c. Capability Assessment of Current Inventory

| Day | Surviving[a] aircraft | Aircraft avail | Fraction flying program achieved | Program flying hrs/acft/day |
|---|---|---|---|---|
| 1 | 150 | .97 | 1.00 | 3.4 |
| 2 | 200 | .88 | 1.00 | 5.6 |
| 3 | 200 | .74 | 1.00 | 6.8 |
| 4 | 200 | .63 | .85 | 10.0 |
| 5 | 200 | .57 | .76 | 10.0 |

[a]From the scenario data (Table 2-5).

(1) Estimated flying hours on the first iteration of each day are equal to the daily program hours (Table 2-5) or the flying hour potential of surviving non-NMCS aircraft, whichever is smaller. Surviving non-NMCS aircraft are the difference between cumulative aircraft surviving (Table 2-5) and the total NMCS aircraft computed on the last iteration of the preceding page. The associated flying hour potential is the product of this difference and the maximum flying hours/aircraft/day from Table 2-5.

(2) The cumulative net demand entries in Table 2-13a are calculated based on the estimated flying hours of each day and iteration. Thus, as long as estimated flying hours equal the flying program these values are identical to the cumulative net demand entries of Tables 2-7 through 2-10 (which are based on the program hours). This applies through Day 3 in the example. Entries for subsequent days can be determined by subtracting (failure rate x cumulative flying hour deficit) from the appropriate entry in Tables 2-7 through 2-10. For example, on iteration 2 of Day 4, the estimate is 1,300 program hours, representing a deficit of 200 hours from the daily program. Thus, the associated cumulative net demand entry for Part 1 is 200 x .08 = 16 less than the cumulative demand entry (70) of Table 2-7. Similarly, the Part 2 entry is 200 x .02 = 4 less than the Day 4 net demand entry (61) of Table 2-8. On Day 5, iteration 2, the cumulative flying hour deficit is the sum of the deficits from the last iterations for Days 4 and 5, viz (1,500 - 1,300) + (1,500 - 1,165) = 535 hours. The above adjustment technique is a short-cut which yields the same answer as direct calculation.

**(3)** The "NMCS aircraft" column of Table 2-13a is just the larger of the "cum net demand/QPA" values for the full-sub set and phase, and is the sum of the "cum net demand" entries for the no-sub set and phase.

**(4)** "Total NMCS aircraft" in Table 2-13b is just the sum of the NMCS aircraft from each phase.

**(5)** Available aircraft are computed as (surviving aircraft - total NMCS aircraft), where surviving aircraft is from the scenario data (Table 2-5).

**(6)** Achieved daily flying hours is just the smaller of (avail acft x 10) and the daily flying program. Recall that maximum flying hours/acft/day = 10.

**(7)** Program flying hours/acft/day is, from Table 2-13c, the quotient of the achieved flying hours and the available aircraft.

**(8)** The (EFH-AFH)/(avg daily FHP) column of Table 2-13b is a "closeness measure." EFH denotes estimated flying hours while AFH denotes achieved flying hours. Their difference is divided by the average program flying hours per day for the scenario. If this is small enough, iterations terminate. Since Table 2-5 specified "desired convergence = 0," estimated flying hours must equal achieved flying hours in order for iterations to terminate due to closeness. When EFH does not equal AFH, daily interations continue up to the maximum iteration limit (2) specified in Table 2-5. If iterations continue, the average of estimated and achieved flying hours for this iteration becomes the estimated flying hours for the next iteration. Thus, (1,500 + 1,100)/2 = 1,300 hours is the estimated flying hours for iteration 2 of Day 4.

**(9)** Daily aircraft availability in Table 2-13c is calculated as the ratio of computed available aircraft (from the last daily iteration of the previous section of the table (2-13b) and surviving aircraft. Daily fraction flying program achieved is the achieved daily flying hours (from the last iteration) divided by the program hours.

**h. Constrained Cost Residual Requirement Solution.** Two algorithms are applied, and the better solution (in terms of flying hour productivity) is chosen. The starting base for each algorithm is the unconstrained cost solution (Table 2-11). From Table 2-5, the residual cost limit is $2,300. The complete calculations for the example case are too complex to represent here; however, the following steps illustrate algorithm application:

**(1)** Algorithm 1 (para 2-6a) first applies the constrained cost algorithm of basic PARCOM (para 2-5) to the no-sub parts in the unconstrained cost solution using the input cost limit ($2,300). Any money "left over" is applied to buy a cost-effective slice of the full-sub parts in the unconstrained cost solution. Since the cost limit exceeds the price of the no-sub part set in the example unconstrained cost solution ($900 = 0 x 400 + 30 x 30), the basic PARCOM no-sub solution is the entire no-sub solution set, and $1,400 is left over to buy full-sub parts. To obtain a cost-effective slice from this, Table 2-14 is used. The "full-sub parts" column shows, for each day, the cost of the full-sub parts in the total unconstrained cost requirements solution for the scenario truncated at that day. Extended PARCOM internally operates with this table. Such a "dollar vs day" table shows the full-sub portion of total requirements cost through each day. From the table, the day with associated full-sub parts cost closest to (but no more than) the money left over ($1,400) is Day 4, with a full-sub cost of $1,350. Extended PARCOM then generates a standard unconstrained cost solution (as in Table 2-11) for the example with a 4-day scenario. The full-sub parts in that solution are extracted and merged with the no-sub parts found earlier. The resulting merged solution is shown in Table 2-15. Extended PARCOM then applies the capability assessment algorithm for current inventory/constrained cost to generate the fleet capability assessment resulting from adding the algorithm 1 solution to current inventory. The resulting average fraction flying program achieved (.947) is noted for later use.

(2) Algorithm 2 (Figure 2-7) is similar to the second phase of algorithm 1 except that it operates on all parts. Table 2-14 shows the residual requirement costs (all parts) through each day. Day 4 is the day for which the associated cost ($1,950) is closest to (but does not exceed) the input cost limit ($2,300). Extended PARCOM then generates a standard unconstrained cost solution for the example with a 4-day scenario. That solution (shown in Table 2-16) is the algorithm 2 solution. A capability assessment is again done, but with the algorithm 2 requirement added to current inventory. The resulting average fraction flying program achieved is .946 of the required program.

**Table 2-14. Residual Requirement Costs Through Given Day**

| Day | Full-substitution parts ($) | No-substitution parts ($) | All parts ($) |
|---|---|---|---|
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 |
| 4 | 1,350 | 600 | 1,950 |
| 5 | 5,400 | 900 | 6,300 |

Table 2-15. Algorithm 1 Constrained Cost Solution

| Full substitution | | No substitution | |
|---|---|---|---|
| Part | Requirement | Part | Requirement |
| 1 | 20 | 3 | 0 |
| 2 | 11 | 4 | 30 |

Table 2-16. Algorithm 2 Constrained Cost Solution

| Full substitution | | No substitution | |
|---|---|---|---|
| Part | Requirement | Part | Requirement |
| 1 | 20 | 3 | 0 |
| 2 | 11 | 4 | 20 |

(3) The solution yielding the higher average fraction flying program achieved is then selected as the overall solution. For the example, the algorithm 1 solution is chosen as the final solution. The already-computed algorithm 1 capability assessment then applies.

(4) Note that the solutions generally only approximate the input cost limit. The approximation is necessary because the full-sub part requirements are determined by incrementing over whole (i.e., nonfractional) days of flying program sustainability. For very small problems, such as in the example, the approximation may be poor in dollar terms. However, the solution cost is usually closer to the cost limit in large problems. In all cases, the difference between the solution cost and the cost limit must be less than a single extra day of flying program sustainability.

# CHAPTER 3

## OPERATIONAL CONSIDERATIONS AND CAVEATS

**3-1. CASE OBJECTIVES.** The user can specify a flying hour objective in conjunction with an aircraft availability objective. For each of these, one of two subobjectives is selected. The associated case types are noted below.

**a. Maximizing Cumulative Flying Hours Achieved.** This flying hour objective is always operating when running a constrained cost case. It entails the direct determination of the parts mix which will yield the greatest number of achieved flying hours for a specified cost limit. The flying hours achieved will be less than the desired flying hour program if the cost limit is less than the cost of the unconstrained cost solution mix.

**b. Maximizing Consecutive Daily Program Flying Hours Achieved.** This flying hour objective is relevant only to constrained cost cases since, for unconstrained cost cases, achieved flying hours = program flying hours. Obtaining a solution with this objective is a two-stage process. First, the user runs Extended PARCOM in an unconstrained cost mode for the full wartime period. The output list from that run shows, for each day, the cumulative cost of the add-on parts that would have been required if the war had been truncated at that day. D, the last day on that list for which the associated cost is less than or equal to the cost limit of the constrained cost case, is then the maximum number of consecutive days of 100 percent flying program sustainability with "cost limit" spares dollars. Next, to get the solution mix associated with D, Extended PARCOM is rerun, in the unconstrained cost mode, with a truncated war of D days length.

**c. Minimum Specified Daily Aircraft Availability.** This objective is in addition to any flying hour objective and is operative in all cases. The availability objective may increase the demand for available aircraft beyond those required to achieve the flying program. The input availability constraints are, as described previously, used to calculate daily allowed NMCS aircraft, which, in turn, are used in all case calculations.

**d. No Specified Aircraft Availability.** Extended PARCOM must always read in values for minimum daily aircraft availability objectives. However, entering blank or zero equates to not specifying an availability objective.

**3-2. CAPABILITY ASSESSMENT.** Normally, Extended PARCOM capability assessments are performed after add-on requirements are determined for both unconstrained and constrained cost cases. In the unconstrained cost cases, flying hour and availability goals are fully met, so the assessed achievements are simply the same as the goals. However, average availability over the course of the war, which cannot be input as a goal, is also determined. For constrained cost cases, days of sustainability, fraction of daily and total flying hour program achieved, and daily and average aircraft availabilities are determined. At times, however, it is also desirable to be able to assess the degree to which an aircraft fleet, with its current or some other starting inventory (and no add-ons), can meet specified flying or availability goals. This can be done in Extended PARCOM for a variety of user-specified partial-substitution replacement policies. An assessment under the policy specified for requirements cases is always generated. However, the user may define a number of other partial-substitution policies for which individual current inventory capability assessments are desired from a single model "run." The partial-substitution policies are specified in terms of the partition of the parts data base into full-sub and no-sub part sets.

**3-3. IMPACT OF PARTS DISTRIBUTION OVER TIME.** The distribution of parts over time, as opposed to front loading of stocks, has no effect on Extended PARCOM results if all initial assets reach retail before they are required (as replacements). An ideally efficient stockage and transportation system will achieve this. Parts distribution over time may effect an increase in requirements, relative to front loading, if initial assets are sufficiently delayed so that they do not arrive in retail before all retail stocks are drawn down. In effect, such delayed assets may have their usefulness negated because they are in the wrong place at the wrong time. Similarly, the effect of such delays on capability assessment of current inventory may be a decrease in the period over which the flying program can be continuously sustained.

**3-4. CAVEATS AND LIMITATIONS.** The principal caveats and limitations on use of the Extended PARCOM Model, as applied in the study, are discussed below. Program modification and/or restructuring is required to extend model capabilities beyond the cited limits.

**a. Number of Part Types Processed.** The Extended PARCOM Model version demonstrated at the US Army Concepts Analysis Agency (CAA) can process at most 300 different part types. Simple (but memory consuming) modifications to the structure of the program can significantly increase this capacity.

**b. Restrictive Partial-Substitution Policy Definition.** Extended PARCOM only treats one concept of partial substitution. Other concepts may not be adaptable to the model methodology. The deterministic (as opposed to stochastic) nature of the model limits the range of processes which can be "added on."

**c. Only Two Centralized Supply Levels.** Extended PARCOM shares the Overview Model "world view" of a retail level and a wholesale level. With full substitution, each level has full cross-leveling (lateral transferability) of parts.

**d. No Indenture Levels.** Part types in the Extended PARCOM (and Overview) data base are nonoverlapping modular units, i.e., no part is a subcomponent of another listed part type. Use of indentured data is not processable in Extended PARCOM.

**e. No Direct Maintenance Modeling.** As with Overview, Extended PARCOM treats maintenance only indirectly, by incorporation into the repair time or by using an aircraft deployment/attrition data base, which is adjusted for aircraft down ("lost") due to maintenance constraints. Such adjustments could be based on results of a separate high-resolution simulation model which previously processed a "slice" of the scenario.

**f. No Stochastic Results.** All Extended PARCOM results are "expected value." Neither input nor results have variable probabilistic aspects (e.g., confidence levels). Safety levels would have to be treated separately as an add-on to Extended PARCOM quantities. However, use of expected values is meaningful for comparisons and parametric evaluations. Methodology for incorporating stochastic considerations into Extended PARCOM would be complex. Conversion of the model into a stochastic simulation could entail high risk for an uncertain payoff.

# CHAPTER 4

## POTENTIAL PROGRAM MODIFICATION

**4-1. MODULE FUNCTIONS.** Figure 4-1 shows the main and subprogram modules of Extended PARCOM. The subprograms consist of seven subroutines and one function. A summary of operational purpose is given below for each module. Details of module operations can be read in the commented FORTRAN code for Extended PARCOM presented in Appendix A.

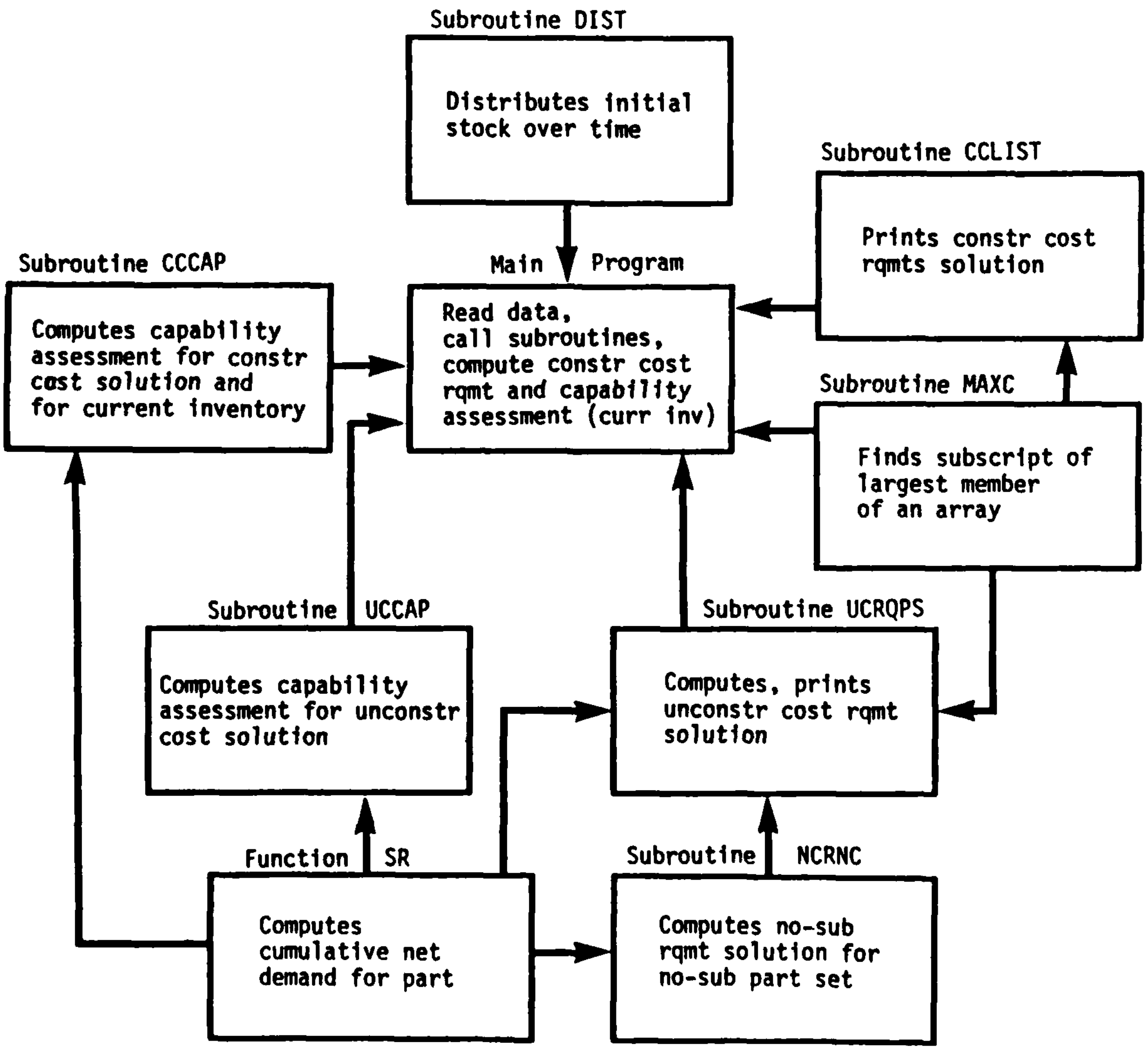


Figure 4-1. Extended PARCOM Subprogram Modules

**a. Main Program.** The Extended PARCOM main program:

**(1)** Reads in all part and scenario data.

**(2)** Prints summaries of the part and scenario data input.

**(3)** Calls subroutine MAXC to order the part data base by part unit cost.

**(4)** Calls subroutine DIST to distribute initial stock over time.

**(5)** Calls subroutine UCRQPS to compute requirements and costs for the unconstrained cost case.

**(6)** Calls subroutine UCCAP to compute capability assessment of the unconstrained cost solution mix.

**(7)** Computes requirements and costs for the constrained cost case.

**(8)** Calls subroutine CCLIST to print the constrained cost solution.

**(9)** Calls subroutine CCCAP to compute capability assessment for the constrained cost solution.

**(10)** Calls subroutine CCCAP to compute capability assessment of current inventory with various user-specified partial-substitution policies.

**b. Subroutine UCRQPS.** Subroutine UCRQPS is called only by the main program. It computes and prints the least-cost requirements mix of spare parts needed to achieve the case objective, given unconstrained funds. In addition to computing the unconstrained cost requirement, the subroutine operation is a part of the constrained cost requirements algorithm in the main program. Subroutine UCRQPS calls:

**(1)** Subroutine NCRNC which computes unconstrained cost no-sub requirements solutions over only the no-sub part set. These solutions are used by the partial-substitution requirements algorithm.

**(2)** Function SR which is used to compute cumulative net demand for each part.

**(3)** Subroutine MAXC which is used to order computed requirements either in order of part unit cost or in order of amount of requirement.

**c. Subroutine UCCAP.** Subroutine UCCAP is called by the main program and calls function SR. It computes fleet capability (average availability, average program flying hours/aircraft/day) based on the unconstrained cost solution being stocked in the war reserve.

**d. Subroutine CCCAP.** Subroutine CCCAP is called by the main program and calls function SR. It computes fleet capability assessment based on the constrained cost solution being stocked in the war reserve. It is also called by the main program to compute capability assessments of current inventory for a series of user-specified partial-substitution policies.

**e. Subroutine CCLIST.** Subroutine CCLIST is called by the main program to print the constrained cost requirements solution. It calls subroutine MAXC for use in ordering the requirements list.

**f. Subroutine DIST.** Subroutine DIST is called by the main program and calls no external routines. It distributes the initial spares stock of a part type over a user-specified series of 5-day intervals.

**g. Subroutine MAXC.** Subroutine MAXC is called by the main program, by subroutine UCRQPS, and by subroutine CCLIST. It calls no external routines. This subroutine finds the largest member of a subscripted array. It is useful in rank-ordering a list according to the numeric value of a list attribute.

**h. Subroutine NCRNC.** Subroutine NCRNC is called by subroutine UCRQPS and calls function SR. It calculates a basic PARCOM unconstrained cost requirements solution for a no-substitution replacement policy. Its operation is an element of the Extended PARCOM partial-substitution requirements algorithm.

**i. Function SR.** Function SR is called by subroutine UCRQPS, by subroutine NCRNC, by subroutine UCCAP, and by subroutine CCCAP. No external routines are called. This function calculates the cumulative net demand through a specified day for a specified part based on a specified flying program. A zero initial inventory is assumed in this calculation.

**4-2. ARRAY STORAGE.** Definitions and sizes of Extended PARCOM array variables are given in the comments of the program code displayed in Appendix A. The types of arrays are local, as defined by DIMENSION statements, common, as defined by unlabeled COMMON, and character, as defined by CHARACTER declarations. Character variables occupy four words per entry in Extended PARCOM while other arrays require only one word per entry. During execution on the Sperry 1100/82 computer, Extended PARCOM occupies 47,000 words of memory.

**4-3. EXTENSION OF DAY LIMIT.** In the Extended PARCOM version delivered by CAA, 17 single-subscript arrays and 2 double-subscript arrays are defined in terms of the maximum number of days in the scenario. The current limit is 120 days. Those arrays of size 120 may be increased in size (through user reprograming) to the scenario length desired insofar as computer memory permits. The arrays associated with the day limit, their dimensions, and the routines defining them are listed in Table 4-1.

Table 4-1. Extended PARCOM Arrays with a Day Limit Dimension

| Array | Routine | Array | Routine | Array | Routine |
|---|---|---|---|---|---|
| AC(120) | COMMON | DCOST1(120) | COMMON | FHR(120) | COMMON |
| ALLOW1(120) | COMMON | DCOSTF(120) | COMMON | IFHC(120) | COMMON |
| ALLOWB(120) | COMMON | FHA(120) | COMMON | RNC(120) | COMMON |
| ALR(120) | Main | FHNC(120) | CCCAP | SM(120,100) | COMMON |
| ASURV(120) | COMMON | FHNZ(120) | CCCAP | SUMB(120) | COMMON |
| AVM(120) | COMMON | FHPAPD(3,120) | COMMON | SUMBZ(120) | NCRNC |
| | | | | SUMP(120) | NCRNC |

**4-4. EXTENSION OF TOTAL PARTS LIMIT.** In the Extended PARCOM version delivered by CAA, 37 single-subscript arrays and 1 double-subscript array are defined in terms of the maximum number of parts to be processed. The current limit is 300 parts. Those arrays of size 300 may be increased in size (through user reprograming) to any limit permitted by computer memory. The arrays associated with the parts limit and the routines defining them are shown in Table 4-2.

**4-5. CAVEATS.** If the day and/or parts limits are increased, the processing time required for Extended PARCOM requirements run execution increases by at least the product of the two limit multipliers, i.e., doubling the day limit and the part limit will at least quadruple processing time. The reader should note that capability assessments without requirements calculations (a user option) are much faster than executions with requirements calculations.

Table 4-2. Extended PARCOM Arrays with a Parts Limit Dimension

| Array | Routine | Array | Routine | Array | Routine |
|---|---|---|---|---|---|
| ADESC(300) | COMMON | DCY(300) | COMMON | PTDEP(300,24) | COMMON |
| AMSN(300) | COMMON | DF(300) | COMMON | QPA(300) | COMMON |
| BC(300) | Main | DMD(300) | COMMON | RNCS(300) | COMMON |
| BCY(300) | COMMON | DMDT(300) | CCCAP | SRMAX1(300) | COMMON |
| BF(300) | COMMON | DOD(300) | COMMON | STK(300) | COMMON |
| CDMDA(300) | COMMON | DSER(300) | Main | TRNCS(300) | COMMON |
| CF(300) | COMMON | DUNSER(300) | Main | TSTK(300) | COMMON |
| CLASS(300) | Main | FR(300) | Main | RMIN(300) | UCRQPS |
| CNCS(300) | COMMON | IFS(300) | COMMON | WRES(300) | Main |
| COST(300) | COMMON | INS(300) | COMMON | WRESU(300) | Main |
| CRNCS(300) | COMMON | IRC(300) | COMMON | XRNCS(300) | Main |
| DAY1D(300) | Main | IRO(300) | COMMON | ZNRT(300) | Main |
| DC(300) | Main | OST(300) | Main | | |

# APPENDIX A

## EXTENDED PARCOM PROGRAM SOURCE CODE

(NOT USED)

# MAIN PROGRAM

```
C NAME: PARCOM-X         TYPE: MAIN PROGRAM
C
C WRITTEN BY: WALTER BAUMAN/AUTOVON -295-1662
C        AT: US ARMY CAA/8120 WOODMONT AVE,BETHESDA,MD 20814
C
C PURPOSE: THE PARCOM-X (PARTS REQUIREMENTS AND COST MODEL-EXTENDED) IS USED
C TO GENERATE COST EFFECTIVE MIXES OF SPARE PARTS REQUIRED TO ACHIEVE A
C FLYING PROGRAM/AVAILABILITY OBJECTIVE UNDER A USER-SPECIFIED
C      -PART REPLACEMENT POLICY (EITHER  FULL,PARTIAL OR NO SUBSTITUTION)
C      -(PURCHASE) COST CONSTRAINT
C
C IN ADDITION,THE PROGRAM ALLOWS THE CAPABILITY ASSESSMENT OF AN AIRCRAFT
C FLEET BASED ON A USER-SPECIFIED SPARES INVENTORY APPLIED UNDER A
C VARIETY OF USER-SPECIFIED PARTS REPLACEMENT POLICIES
C
C ARGUMENTS: NOT  APPLICABLE
C
C CALLED BY: NOT  APPLICABLE
C
C CALLS
C      -SUBROUTINE MAXC: SELECTS LARGEST SUBSCRIPT OF AN ARRAY. USED TO
C                        ORDER  PART TYPES IN DECREASING ORDER OF UNIT COST.
C      -SUBROUTINE CCCAP: PERFORMS A FLEET CAPABILITY ASSESSMENT BASED ON
C                         A SPARES STOCK EQUAL TO THE CONSTRAINED COST SOLUTION
C                         AND/OR CURRENT INVENTORY
C      -SUBROUTINE CLIST: PRINTS SELECTED CONSTRAINED COST SOLUTIONS
C      -SUBROUTINE DIST: DISTRIBUTES PARTS TO THEATER OVER 5-DAY INTERVALS
C      -SUBROUTINE UCROPS: COMPUTES A COST-EFFECTIVE REQUIREMENTS MIX BASED
C                          ON THE UNCONSTRAINED COST SOLUTION BEING STOCKED
C      -SUBROUTINE UCCAP: COMPUTES FLEET CAPABILITY ASSESSMENT BASED
C                         ON THE UNCONSTRAINED COST SOLUTION BEING STOCKED
C
C FILES USED : INPUT - UNIT 10 (PARTS DATA)
C                    - UNIT 11 (SCENARIO DATA)
C              OUTPUT - UNIT 6 (PRINT)
C
C
C LOCAL ARRAYS
C
C
C NAME       DIMENSION  TYPE            DESCRIPTION
C
C ALR(I)           120  REAL    NR ACFT LOST(ATTRITION) ON DAY I
C
C AM(I)             61  REAL    AC AVAILABILITY CONSTRAINT FOR I-TH
C                               'DAY INTERVAL',I.E. MINIMUM REQUIRED ACFT
C                               AVAILABILITY IN I-TH 'DAY INTERVAL'
C
C AMSN(J)          300  CHAR    IDENTIFICATION NR(NSN) OF SPARE PART J
C
C BC(J)            300  REAL    BASE(RETAIL) CONDEMNATION RATE OF PART J
C                               (=FRACTION FAILURES 'JUNKED' AT RETAIL LEVEL)
C
C CLASS(J)         300  REAL    IDENTIFYING LABEL FOR PART SET WHICH PART J
C                               BELONGS TO .(EITHER FULL-SUB OR NO-SUB)
C
C DAY1D(J)         300  REAL    AMOUNT OF ASL/PLL STOCK FOR PART J WHICH
C                               IS IN-PLACE ON DAY 1
C
C DC(J)            300  REAL    DEPOT CONDEMNATION RATE OF PART J
C                               (FRAC FAILURES 'JUNKED' AT DEPOT LEVEL)
C
C DSER(J)          300  REAL    AMOUNT OF SERVICEABLE INITIAL DEPOT STOCK
C                               FOR PART J
C
C DUNSER(J)        300  REAL    AMOUNT OF UNSERVICEABLE INITIAL DEPOT STOCK
C                               FOR PART J
C FR(J)            300  REAL    FAILURE(REPLACEMENT) RATE FOR PART J
C                               EXPRESSED AS EXPECTED NR OF FAILURES
C                               PER FLYING HOUR FLOWN.
C
C IDAY(I)           61  FIXED   ARRAY WHICH TEMPORARILY STORES INPUT DATA ON
C                               DAYS BEGINNING 'DAY INTERVALS' (IDAY(I) TO
C                               IDAY(I+1)) IN WHICH VARIOUS INPUT DATA
C                               TAKE EFFECT
C
C NAC(I)            61  FIXED   NR OF AC DEPLOYED AT START OF I-TH TIME
C                               INTERVAL (IDAY(I) TO IDAY(I+1))
C
C NFH(I)            61  FIXED   FLYING HR REQMT DURING I-TH TIME
C                               INTERVAL (IDAY(I) TO IDAY(I+1))
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C
C OST(J)              300  REAL     ORDER/SHIP TIME (DAYS) FOR PART J
C                                   (=INPUT-SPECIFIED OST + ADDOST)
C
C PT(K)                24  REAL     AMOUNT OF PART J DEPLOYED AFTER DAY 1 AND
C                                   BETWEEN DAY 5*K-4 AND DAY 5*K
C
C WRES(J)             300  REAL     AMOUNT OF SERVICEABLE INITIAL WAR RESERVE FOR
C                                   PART J
C
C WRESU(J)            300  REAL     AMOUNT OF UNSERVICEABLE INITIAL WAR RESERVE FOR
C                                   PART J
C
C XRNCS(J)            300  REAL     ARRAY FOR TEMPORARILY STORING THE CONSTRAINED
C                                   COST SOLUTION REQMT COMPUTED BY THE CONSTR
C                                   COST ALGORITHM 1 FOR PART J.
C
C ZLOSS(I)             61  REAL     NUMBER OF DAILY AC LOSSES BY ATTRITION
C                                   DURING I-TH TIME INTERVAL (IDAY(I) TO
C                                   IDAY(I+1))
C
C ZNRT(J)             300  REAL     NRTS (NOT REPAIRABLE THIS STATION) FRACTION
C                                   FOR PART J . THIS IS THE FRACTION OF FAILURES
C                                   WHICH ARE SENT TO DEPOT FOR REPAIR.
C
C
C
C COMMON BLOCK (UNLABELED) ENTRIES
C
C
C NAME       DIMENSION  TYPE              DESCRIPTION
C
C
C AC(I)               120  REAL     NR  ACFT DEPLOYED ON DAY I
C
C ACL                   1  REAL     THE AMOUNT(S) OF SUSTAINABILITY DOLLARS,
C                                   BASED ON THE 'CUM REQMT COST THRU DAY N'
C                                   TABLES,WHICH IS THE CLOSEST APPROXIMATION
C                                   TO THE INPUT  COST LIMIT FOR THE CONSTRAINED
C                                   COST CASE
C
C
C ADESC(J)            300  CHAR     16 CHAR DESCRIPTION OF SPARE PART J
C
C ALLOW1(I)           120  REAL     THE 'ALLOWABLE NMCS ACFT' FOR THE NO-SUB
C                                   SET ON DAY I,COMPUTED AFTER DAY I IS PROCESSED.
C                                   AFTER IT IS CALCULATED FOR DAY I, IT IS FIXED
C                                   DURING ITERATIVE CALCULATIONS (INVOLVING DAYI)
C                                   FOR NO-SUB REQMTS ON LATER DAYS.
C
C ALLOWB(I)           120  REAL     MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
C                                   WILL STILL ALLOW ACHIEVMENT OF CASE OBJECTIVE
C                                   (FLYING HOUR AND AVAILABILITY) ON DAY I
C
C AMSN(J)             300  CHAR     IDENTIFICATION NR(NSN) OF SPARE PART J
C
C ASURV(I)            120  REAL     NR AC SURVIVING (NOT ATTRITTED)ON DAY I
C
C AVAVG(K)              6  REAL     AVAVG(1)=AVG ACFT AVAIL ,FROM CAPABILITY
C                                   ASSESSMENT,BASED ON STOCKAGE OF EITHER
C                                   CURR INV OR ( CURR INV + COMPUTED ADD-ON
C                                   REQMTS SOLUTION)
C
C                                   AVAVG(2)=AVG MIN ACFT REQ'D TO ACHIEVE
C                                   THE FLYING HR/AVAILABILITY OBJECTIVE.
C
C                                   AVAVG(3)=AVG FLY HR/AVAIL ACFT / DAY
C                                   ,FROM CAPABILITY ASSESSMENT, BASED ON
C                                   EITHER CURR INV OR (CURR INV + THE SOLUTION
C                                   REQMT) BEING STOCKED.
C
C AVM(I)              120  REAL     AC AVAILABILITY CONSTRAINT (MIN REQUIRED
C                                   NON-NMCS ACFT) FOR DAY I.
C
C BCY(J)              300  REAL     BASE(RETAIL) REPAIR TIME FOR PART J (INPUT)
C
C BF(J)               300  REAL     A COEFFICIENT USED IN THE CALCULATION OF
C                                   NET DEMAND (SR(I,J,..)) FOR PART J. IT EQUALS
C                                   (1-BC(J))*(1-ZNRT(J))*CF(J).
C
C
C CASE                     CHAR     CASE ID
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C
C COMDA(J)          300  REAL    ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
C                                 (BASED ON INITIAL STK=0) FOR PART J ON THE
C                                 SCENARIO DAY BEING PROCESSED
C
C CF(J)             300  REAL    A COEFFICIENT USED IN CALCULATION OF NET
C                                 DEMANDS(SR(I,J,..)) FOR PART J. IT=
C                                 FR(J)*OPA(J)
C
C CL                  1  REAL    THE COST LIMIT (AS SPECIFIED  BY INPUT) USED
C                                 IN THE CONSTRAINED COST REQMTS CASE.
C
C CMINT               1  REAL    TOTAL COST OF THE REQMT FOR THE UNCONSTRAINED
C                                 COST CASE
C
C CNCS(J)           300  REAL    TOTAL COST  OF REQMT FOR PART J USING
C                                 THE SPECIFIED PART  REPLACEMENT POLICY.
C
C COST(J)           300  REAL    COST OF A SINGLE ITEM OF PART J . THIS IS
C                                 ALSO DENOTED AS 'PART UNIT COST'.
C
C CRNCS(J)          300  REAL    THE UNCONSTRAINED COST SOLUTION REQMT FOR
C                                 PART J AT ANY STAGE OF THE PARTIAL SUB
C                                 REQUIREMENT CALCULATION ALGORITHM.
C
C DCOST1(I)         120  REAL    THE TOTAL CUMULATIVE REQMTS COST THRU DAY I
C                                 FOR THE FULL SUB PARTS ONLY. I.E.  THIS IS
C                                 THE PORTION OF THE 'CUM REQMTS COST THRU DAY N'
C                                 ENTRY WHICH IS ASSOCIATED WITH THE FULL SUB
C                                 PART SET.
C
C DCOSTF(I)         120  REAL    CUMULATIVE COST OF THE FULL REQUIREMENT
C                                 (ALL  PARTS) THRU DAY I USING THE SPECIFIED
C                                 PART REPLACEMENT POLICY WITH UNCONSTRAINED
C                                 COST.
C
C
C DCY(J)            300  REAL    DEPOT RECYCLE TIME FOR PART TYPE J. THIS IS
C                                 TIME BETWEEN REMOVAL AND RETURN FROM DEPOT
C                                 REPAIR. THIS = DEPOT REPAIR TIME + 2*ORDER
C                                 SHIP TIME.
C
C DF(J)             300  REAL    A COEFFICIENT USED IN CALCULATION OF NET
C                                 DEMANDS(SR(I,J,..)) FOR PART J. IT=
C                                 (1-DC(J))*ZNRT(J)*CF(J)
C
C DMD(J)            300  REAL    WORKING VARIABLE USED  IN CALCULATION OF
C                                 NET DEMAND(SR(I,J,..)) FOR PART J ON DAY I
C                                 DURING CAPABILITY ASSESSMENT.
C                                 WHEN (CUM)NET DMD THRU DAY I IS BEING
C                                 CALCULATED,DMD(J) IS (CUM) NET DMD THRU THE
C                                 PREVIOUS DAY.
C
C DOD(J)            300  REAL    ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
C                                 IN SUBROUTINE MAXC. IN MAIN PGM,THIS HAS PART
C                                 UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
C                                 UCRQPS,THIS HAS THE AMOUNT OF THE SOLUTION
C                                 REQMT FOR PART J.
C
C FHA(I)            120  REAL    DURING UNCONSTR COST REQMT CALCULATIONS(ROUTINE
C                                 UCRQPS) AND  DURING UNCONSTR COST CAPABILITY
C                                 ASSESSMENTS(ROUTINR UCCAP) THIS IS THE FLEET
C                                 FLYING PROGRAM FLYING HOURS REQUIRED ON DAY I.
C                                 DURING THE CONSTR COST CAPABILITY ASSESSMENT
C                                 (SUBROUTINE CCAPS) THIS IS THE INITIAL ESTIMATE
C                                 FOR FLYING HRS ACHIEVED ON DAY I WHEN
C                                 EITHER CURR INV OR (CURR INV + COMPUTED
C                                 CONSTRAINED COST ADD-ON REQMT)  IS STOCKED.
C                                 DURING CAPABILITYASSESSMENT THIS IS RECURSIVELY
C                                 COMPUTED
C
C FHM                    REAL    MAXIMUM FLYING HRS PER ACFT PER DAY(INPUT)
C
C FHPAPD(K,I)     3,120  REAL    FHPAPD(1,I)=FLYING HRS PER AVAILABLE ACFT PER
C                                 FOR DAY I UNDER THE SPECIFIED REPLACEMENT
C                                 POLICY BASED ON STOCKING (CURRENT INV +
C                                 THE UNCONSTRAINED COST SOLUTION)
C
C
C                                 FHPAPD(3,I)=FLYING HRS PER AVAILABLE ACFT PER
C                                 FOR DAY I UNDER THE SPECIFIED REPLACEMENT
C                                 POLICY STOCKING EITHER CURRENT INVENTORY OR
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      C                                        (CURR INV + THE CONSTRAINED COST SOLUTION)
      C
      C FHS(I)           120   REAL            DURING THE CONSTR COST CAPABILITY ASSESSSMENT
      C                                        THIS IS FLEET PROGRAM FLYING HOURS REQUIRED
      C                                        ON DAY I(ACCORDING TO THE INPUT FLYING HR PGM)
      C
      C FR(J)            300   REAL            FAILURE(REPLACEMENT) RATE FOR PART J
      C                                        EXPRESSED AS EXPECTED NR OF FAILURES
      C                                        PER FLYING HOUR FLOWN.
      C
      C ICOST              1   FIXED           INDICATOR WHICH TELLS SUBROUTINE UCROPS WHETHER
      C                                        TO PRINT THE PARTS REQMTS LIST (0=DO 1=DON'T).
      C                                        REQMTS LIST IS NOT PRINTED DURING CONSTRAINED
      C                                        COST REQMT CALCULATIONS.
      C
      C IDCC(IND)          2   FIXED           STORES ,FOR EITHER TOTAL(IND=1) OR RESIDUAL
      C                                        (IND=2), THE LATEST DAY FROM THE ' CUM COST
      C                                        REQMT THRU DAY N' TABLE (FROM THE UNCONSTR
      C                                        COST CASE) FOR WHICH ASSOCIATED CUM COST
      C                                        IS LESS THAN OR = THE INPUT-SPECIFIED COST
      C                                        LIMIT USED IN THE CONSTRAINED COST CASE.
      C
      C IFHC(I)          120   FIXED           INDICATOR TELLING WHICH CONSTRAINT,FLY HR PGM
      C                                        (IFHC(I)=0) OR ACFT AVAILABILITY(IFHC(I)=1),
      C                                        DETERMINES REQUIRED DAILY FLEET AVAILABILITY
      C                                        FOR DAY I
      C
      C IFS(J)           300   FIXED           ARRAY STORING THE PARCOM PART NUMBERS OF THE
      C                                        PARTS IN THE FULL-SUB PART SET.
      C
      C IMSEL                   FIXED           NUMBER OF PART TYPES FOR WHICH INDIV ITEM
      C                                        'CUMULATIVE (UNCONSTR COST) SOLUTION REQMTS
      C                                        THRU DAY N' ARE DESIRED. (SEE SM(I,J) &
      C                                        IPT(J) BELOW)
      C
      C INS(J)           300   FIXED           ARRAY STORING THE PARCOM PART NUMBERS OF THE
      C                                        PARTS IN THE NO-SUB PART SET.
      C
      C INT                1   FIXED           THE INTERVAL AT WHICH THE PARTIAL SUB
      C                                        COMPUTATION ALGORITHM (ROUTINE UCROPS)
      C                                        INCREMENTS VALUES FOR 'ALLOWABLE NMCS ACFT'
      C                                        AT EACH STAGE OF CALCULATION OF SEPARATE REQMT
      C                                        SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB
      C                                        SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS
      C                                        VALUE IS SET =1 IN THE PROGRASM CODE.
      C
      C IPT(J)             5   FIXED           ARRAY STORING INTERNAL PART NRS (SUBSCRIPTS)
      C                                        FOR PARTS FOR WHICH A CUMULATIVE DAY BY DAY
      C                                        REQUIREMENT HISTORY IS TO BE  PRINTED
      C
      C IPC(J)           300   FIXED           ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
      C                                        DECREASING PART UNIT COST FOR ASSOCIATED PART
      C
      C IPU(J)           300   FIXED           ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
      C                                        DECREASING SOLUTION REQMT AMOUNT FOR ASSOCIATED
      C                                        PART
      C
      C NP                 1   FIXED           NR OF PART TYPES PROCESSED IN RUN. (THIS
      C                                        EXCLUDES PART TYPES WITH ESSENTIALITY CODE
      C                                        .LE. IESS OR WITH A ZERO FAILURE RATE)
      C
      C NP1                1   FIXED           TOTAL NUMBER OF 'PART NUMBERS' IN THE FULL-SUB
      C                                        PART SET
      C
      C NP2                1   FIXED           TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
      C                                        PART SET
      C
      C NN                 1   FIXED           LENGTH(DAYS) OF SCENARIO
      C
      C PTLEP(J,K)    300,24   REAL            TOTAL AMOUNT OF INITIAL STOCK FOR PART J
      C                                        RECEIVED AT THEATER(EXCLUDING IN-PLACE STOCK)
      C                                        BETWEEN DAY 5*K-4 AND DAY 5*K
      C
      C QPA(J)           300   REAL            THE 'QUANTITY PER APPLICATION' FOR PART J,
      C                                        I.E. THE STANDARD NUMBER OF ITEMS OF PART J
      C                                        INSTALLED ON EACH OPERATIONAL ACFT
      C
      C RNC(I)           120   REAL            AC AVAILABILITY IMPLIED BY STOCKAGE OF
      C                                        (COMPUTED RQMT + CURRENT INVENTORY) OR BY
      C                                        STOCKAGE OF ONLY THE CURRENT INVENTORY
      C
      C RNCS(J)          300   REAL            DURING REQMT CALCULATIONS IN MAIN PROGRAM  &
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C                                        IN SUBROUTINES NCRNC,UCROPS AND UCCAP,THIS IS
C                                        THE REQMT FOR PART J WITH UNCONSTRAINED COST.
C                                        DURING CONSTR COST CAPABILITY ASSESSMENT
C                                        (SUBROUTINE CCCAP) THIS IS THE REQMT FOR PART J
C                                        + ISSUED INITIAL STOCK(TSK(J))
C
C SM(I,J)      120,100  REAL             THE CUMULATIVE (UNCONSTR COST) SOLUTION REQMT
C                                        THRU DAY I FOR PART IPT(J)
C
C SRMAX1(J)        300  REAL             A WORKING VARIABLE USED IN THE CALCULATION OF
C                                        THE UNCONSTR COST REQMT FOR A PART J IN THE
C                                        FULL-SUB SET. IT IS THE RUNNING MAXIMUM (OVER
C                                        TIME) OF THE NET DEMAND (INCLUDING INITIAL STK)
C                                        FOR PART J THRU THE DAY BEING PROCESSED
C
C STK(J)           300  REAL             INITIAL SERVICEABLE STOCK OF PART J. IT IS THE
C                                        SERVICEABLE WAR RESERVE + (IN-PLACE ASL/PLL
C                                        ON DAY 1)
C
C SUMB(I)          120  REAL             TOTAL STOCKOUTS OVER ALL PARTS IN THE NO-SUB
C                                        PART SET,AS CALCULATED  DAY I  DURING
C                                        CAPABILITY ASSESSMENT
C
C TRNCS(J)         300  REAL             ARRAY USED TO STORE THE UNCONSTR COST SOLUTION
C                                        REQMT WHILE THE NO-SUB CONSTR COST ALGORITHM
C                                        IS BEING APPLIED TO THE NO-SUB PART SET DURING
C                                        PROCESSING FOR THE CONSTR COST ALGORITHM
C
C TSTK(J)          300  REAL             THE CUMULATIVE STOCK DEPLOYED FOR PART J ON
C                                        THE DAY BEING PROCESSED
C
C TSUMB              1  REAL             THE TOTAL NET STOCKOUT FROM ALL NO-SUB PARTS
C                                        PROCESSED AT ANY STAGE OF THE NO-SUB REQMTS
C                                        CALCULATION PORTION OF THE PARTIAL SUB REQMT
C                                        ALGORITHM
C
C
C NOTEWORTHY SINGLE-SUBSCRIPT NAMES
C
C
C NAME                  TYPE                       DESCRIPTION
C
C
C ADDOST                REAL             CONSTANT ADDED TO INPUT VALUE OF OST
C                                        (ORDER/SHIP TIME AS READ FROM OVERVIEW INPUT)
C                                          TO YIELD THE OST USED IN PARCOM. THE OST
C                                          IS THE SAME FOR ALL PART TYPES. IN PARCOM
C                                          THE OST = ONE-WAY TRAVEL TIME BETWEEN
C                                          AND DEPOT.
C
C ADSC                  REAL             16 CHARACTER DESCRIPTION OF PART J
C
C AX                    REAL             AVERAGE DAILY MINIMUM REQUIRED ACFT AVAIL
C
C BREPL                 REAL             PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
C                                        IF THE BASE(RETAIL) REPAIR TIME  (BCY(J))
C                                        FOR PART J EXCEEDS BREPL, THEN PART J IS PUT
C                                        IN THE FULL-SUB PART SET. IF NOT,IT'S IN THE
C                                        NO-SUB PART SET.
C
C BRR                   REAL             NR OF RETURNING REPAIRS ARRIVING FROM RETAIL
C                                        REPAIR ON A SPECIFIED DAY
C CL                    REAL             THE COST LIMIT USED IN THE CONSTRAINED COST
C                                        CASES
C
C CL1                   REAL             THE AMOUNT ($) OF THE UNCONSTR COST REQMTS
C                                        FROM THE NO-SUB PART SET WHICH ARE 'BOUGHT'
C                                        IN THE TRIAL SOLUTION FROM CONSTR COST
C                                        ALGORITHM 1
C
C CL2                   REAL             THE AMOUNT ($) OF THE UNCONSTR COST REQMTS
C                                        FROM THE FULL-SUB PART SET WHICH ARE 'BOUGHT'
C                                        IN THE TRIAL SOLUTION FROM CONSTR COST
C                                        ALGORITHM 2
C
C CLNCR                 REAL             THE COST LIMIT USED IN THE RESIDUAL (INIT
C                                        STK='CURRENT INVENTORY') REQMTS CASE
C
C CLNCT                 REAL             THE COST LIMIT USED IN THE TOTAL (INIT
C                                        STK=0) REQMTS CASE
C
C CONVF                 REAL             THE CONVERGENCE THRESHOLD (INPUT) USED IN THE
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C                                CAPABILITY ASSESSMENT WITH CONSTRAINED COST OR
C                                WITH 'CURRENT INVENTORY'
C
C DAMT              REAL         THE AMOUNT OF INITIAL STOCK TO BE DISTRIBUTED
C                                IN THEATER OVER A SPECIFIED (PARTS DEPLOYMENT)
C                                TIME PERIOD (SEE IFDAY,ILDAY)
C
C DDIS              REAL         LENGTH(DAYS) OF TIME PERIOD DURING WHICH
C                                INITIAL DEPOT SERVICEABLES ARE RECEIVED
C                                AT THEATER
C
C DLAG              REAL         DELAY(DAYS AFTER DAY 1) BEFORE
C                                INITIAL DEPOT SERVICEABLES ARE RECEIVED
C                                AT THEATER
C
C FNC               REAL         FRACTION OF FLEET FLYING HR PROGRAM (FULL WAR)
C                                WHICH CAN BE ACHIEVED WITH THE CONSTR COST
C                                SOLUTION INVENTORY OR WITH 'CURRENT INVENTORY'
C
C FRLIM             REAL         PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
C                                IF THE FAILURE RATE (FR(J) FOR PART J
C                                EXCEEDS FRLIM, THEN PART J IS PUT IN THE
C                                FULL-SUB PART SET. IF NOT,IT'S IN THE NO-SUB
C                                PART SET.
C
C IFDAY             FIXED        FIRST DAY OF RECEIPT(IN THEATER) OF INITIAL
C                                STOCKS DISTRIBUTED (DEPLOYED) BY SUBROUTINE
C                                DIST
C
C IG                FIXED        IDICATOR TO SUBROUTINE CCLIST OF WHETHER CONSTR
C                                COST ALGORITHM 1(IG=1) OR CONSTR COST ALGORITHM
C                                2 WAS USED TO DETERMINE THE FINAL CONSTR COST
C                                SOLUTION
C
C ILDAY             FIXED        LAST  DAY OF RECEIPT(IN THEATER) OF INITIAL
C                                STOCKS DISTRIBUTED (DEPLOYED) BY SUBROUTINE
C                                DIST
C
C IND               FIXED        INDICATOR OF WHETHER TOTAL(INIT STK=0) OR
C                                RESIDUAL(INIT STK='CURRENT INVENTORY') REQMTS
C                                ARE BEING PROCESSED .IND=1 INDICATES TOTAL
C                                REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
C
C IOPT1             FIXED        RUN OPTION(INPUT). IF IOPT1 .LE. 0,THEN ONLY
C                                'CURRENT INVENTORY' CAPABILITY ASSESSMENT CASES
C                                WILL BE DONE(I.E. NO REQMTS CALC). IF IOPT1
C                                IS .GT. 0,BOTH CURR INV CAP ASSESS AND REQMTS
C                                CASES WILL BE DONE.
C
C IOPT2             FIXED        RUN OPTION(INPUT). IF IOPT2 .LE. 0,THEN THE
C                                FULL- SUB' PART SET USED IN THE
C                                'CURRENT INVENTORY' CAPABILITY ASSESSMENT CASES
C                                WILL NOT BE PRINTED. IF IOPT2 .GT.0 THEY WILL .
C
C IOPT3             FIXED        RUN OPTION(INPUT). IF IOPT3 .LE. 0,THEN THE
C                                NO - SUB  PART SET USED IN THE 'CURR INV'
C                                CAPABILITY ASSESSMENT CASES WON'T BE PRINTED.
C                                IF IOPT3 .GT.0 THEY WILL BE PRINTED.
C
C IOPT4             FIXED        RUN OPTION(INPUT). IF IOPT4 .LE. 0,THEN THE
C                                UNCONSTR COST SOLUTION REQMTS LIST WILL NOT
C                                BE PRINTED (BUT WILL BE COMPUTED INTERNALLY).
C                                IF IOPT4 .GT.0 THE LIST WILL BE PRINTED.
C
C IOPT5             FIXED        RUN OPTION(INPUT). IF IOPT5 .LE. 0,THEN THE
C                                'CUMULATIVE(UNCONSTR COST) REQMTS COSTS THRU
C                                DAY N' LIST WILL NOT BE PRINTED.IF IOPT3 .GT. 0
C                                THE LIST WILL BE PRINTED.
C
C IORD              FIXED        RUN OPTION(INPUT). IF IORD .LE. 0,THEN THE
C                                SOLUTION REQMTS LISTS WILL BE ORDERED ACCORDING
C                                TO DECREASING UNIT COST OF PART.IF OPT3 .GT. 0
C                                THE REQMTS LISTS ARE ORDERED BY (DECREASING)
C                                AMOUNT OF SOLUTION REQMT.
C
C IP                FIXED        INDICATOR TELLING THE CONSTR COST CAPABILITY
C                                ASSESSMENT ROUTINE (CCCAP) WHETHER TO PRINT THE
C                                AMOUNT OF SOLUTION REQMT. THIS IS SET BY THE
C                                MAIN PROGRAM.
C
C IPRT              FIXED        RUN OPTION(INPUT). IF IPRT .LE. 0,THEN THE
C                                SCENARIO INPUT DATA SUMMARY WILL NOT BE PRINTED
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C                                         IF IPRT .GT. 0,IT WILL BE PRINTED
C
C IPRT1                 FIXED             RUN OPTION(INPUT). IF IPRT1 .LE. 0,THEN THE
C                                         FULL-SUB & NO-SUB PART SETS USED IN REQMTS CASES
C                                         WILL NOT BE PRINTED, NOR WILL THE PART DATA
C                                         LIST SUMMARIES AFTER THE FIRST ONE. OTHERWISE
C                                         THESE WILL BE PRINTED.
C
C ISEL                  FIXED             RUN OPTION(INPUT) TELLING WHETHER ONLY TOTAL
C                                         (INIT STK=0) REQMTS (ISEL=0), ONLY RESIDUAL
C                                         (INIT STK=CURR INV) REQMTS (ISEL=1) ,OR BOTH
C                                         TOTAL AND RESIDUAL REQMTS (ISEL=2) ARE TO BE
C                                         PROCESSED IN THIS RUN.
C
C IW                    FIXED             TEMPORARILY STORES NW(THE NR DAYS IN THE WAR)
C                                         WHILE THE CONSTRAINED COST ALGORITHMS OPERATE.
C
C KNTC                  FIXED             THE PARTIAL-SUB POLICY BEING PROCESSED. KNTC=1
C                                         IS THE POLICY USED IN REQMTS CALCULATIONS AND
C                                         IN THE 1ST 'CURRENT INVENTORY' CAPABILITY
C                                         ASSESSMENT. KNTC=2,3... ARE ADDITIONAL POLICIES
C                                         (INPUT) USED ONLY IN CAPABILITY ASSESSMENTS
C                                         OF CURRENT INVENTORY
C
C LIMIT                 FIXED             THE MAXIMUM NUMBER OF ITERATIONS (PER DAY)
C                                         WHICH THE CONSTRAINED COST CAPABILITY
C                                         ASSESSMENT ALGORITHM (SUBROUTINE CCCAP)
C                                         WILL PERFORM BEFORE IT TERMINATES
C
C NFS                   FIXED             AN INPUT INDICATOR TELLING HOW THE FULL-SUB
C                                         SET USED IN REQMTS CALCULATIONS IS DEFINED.
C                                         IF NFS .LT. 0,THE FULL-SUB SET IS DEFINED
C                                         BY FOUR SCREENING LIMITS (BREPL,ZDCY,FRLIM,
C                                         ZNRTL) INPUT ON NEXT CARD. IF NFS .EQ. 0,
C                                         NO PARTS ARE TO BE IN THE FULL-SUB SET(I.E.
C                                         THIS IS A NO-SUB CASE). IF NFS .GT. 0,THEN
C                                         THE NFS(NUMBER OF) PART NUMBERS DESIGNATED
C                                         ON THE NEXT CARD(S) ARE IN THE FULL-SUB SET.
C
C NPTFS                 FIXED             (INPUT) NUMBER OF FULL-SUB PARTS FOR EACH
C                                         PARTIAL-SUB POLICY USED ONLY FOR CAPABILITY
C                                         ASSESSMENT OF CURRENT INVENTORY. IF INPUT
C                                         VALUE OF NPTFS .GT. 0,THEN NPTNS (SEE BELOW)
C                                         IS IGNORED.
C
C NPTNS                 FIXED             (INPUT) NUMBER OF NO-SUB PARTS FOR EACH
C                                         PARTIAL-SUB POLICY USED ONLY FOR CAPABILITY
C                                         ASSESSMENT OF CURRENT INVENTORY. NPTNS IS
C                                         USED ONLY IF THE VALUE OF NPTFS IS 0.
C
C TTFH                  REAL              TOTAL FLYING HOURS IN THE FULL SCENARIO
C                                         FLYING PROGRAM
C
C ZCOST                 REAL              TOTAL VALUE OF 'CURRENT INVENTORY',BASED ON
C                                         PART UNIT COST
C
C ZDCY                  REAL              PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
C                                         IF THE DEPOT REPAIR CYCLE (DCY(J)
C                                         FOR PART J EXCEEDS ZDCY, THEN PART J IS PUT
C                                         IN THE FULL-SUB PART SET. IF NOT,IT'S IN THE
C                                         NO-SUB PART SET.
C
C ZNRTL                 REAL              PARTIAL SUB POLICY SCREENING LIMIT (INPUT).
C                                         IF THE NRTS (ZNRT(J)  FOR PART J EXCEEDS
C                                         ZNRTL, THEN PART J IS PUT IN THE FULL-SUB
C                                         PART SET. IF NOT,IT'S IN THE NO-SUB PART SET.
C
C
       DIMENSION
     +      ALR(120),       AM(61),         BC(300),         DAY1D(300),
     +      DC(300),        DSER(300),      DUNSER(300),     FR(300),
     +      IDAY(61),       NAC(61),        NFH(61),         OST(300),
     +      PT(24),         WRES(300),      WRESU(300),      XRNCS(300),
     +      ZLOSS(61),      ZNRT(300)
       COMMON
     +      AC(120),        ACL,            ADESC(300),      ALLOW1(120),
     +      ALLOWB(120),    AMSN(300),      ASURV(120),      AVAVG(6),
     +      AVM(120),       BCY(300),       BF(300),         CASE,
     +      COMDA(300),     CF(300),        CL,              CMINT,
     +      CNCS(300),      COST(300),      CRNCS(300),      DCOST1(300),
     +      DCOSTF(120),    DCY(300),       DF(300),         DMD(300),
     +      DOD(300),       FHA(120),       FHM,             FHPAPD(3,120),
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```
     *    FHR(120),        ICOST,          IDCC(2),        IFHC(120),
     *    IFS(300),        IMSEL,          INS(300),       INT,
     *    IPT(100),        IRC(300),       IRO(300),       ISHORT,
     *    NP,              NP1,            NP2,            NW,
     *    PTDEP(300,24),   QPA(300),       RNC(120),       RNCS(300),
     *    SM(120,100),     SRMAX1(300),    STK(300),       SUMB(120),
     *    TRNCS(300),      TSTK(300),      TSUMB
      CHARACTER*16
     *    ADESC,           ADSC,           AMSN,           CASE,
     *    CLASS(300),      Z1
      ISHORT=0
      IFCC=1
      DO 100 I=1,2
  100 IDCC(I)=0
      DO 200 I=1,61
        IDAY(I)=0
        AVM(I)=0.
        NAC(I)=0
        NFH(I)=0
        ZLOSS(I)=0
  200 AM(I)=0.
      DO 300 I=1,300
        IFS(I)=0
  300 INS(I)=0
      ZZ=0.
      KNTC=1
C
C READ OST OFFSET,DESIRED CONVERGENCE,MAX ESSENTIALITY PROCESSED,
C DEPOT LAG TIME,AND DEPOT DISTRIBUTION PERIOD
C
      READ (11,9000) ADDOST,CONVF,IESS,DLAG,DDIS
      NP=0
      NP1=0
C
C READ INDICATOR(NFS) OF HOW PARTIAL-SUB POLICY IS DEFINED
C
      READ (11,9100) NFS
C
C IF NFS .LT.0 READ PARTIAL SUB SCREENING LIMITS ON DEPOT REPAIR CYCLE,
C NRTS,BASE(RETAIL) REPAIR CYCLE AND FAILURE RATE
C
      IF (NFS.LT.0) READ (11,9200) ZDCY,ZNRTL,BREPL,FPLIM
C
C IF NFS .GT. 0, READ IN THE PART NUMBERS WHICH DEFINE THE FULL-SUB
C PART SET
C
      IF (NFS.LE.0) GO TO 400
      READ (11,9100) (IFS(J),J=1,NFS)
  400 READ (11,9300) CASE
      READ (10,9400)
      I=0
C
C STMTS 500 TO 800 READ AND PROCESS THE PART DATA BASE INPUT.EACH PART
C HAS 12 RECORDS. THE READ ORDER IS: READ  PART CHARACTERISTICS .
C SKIP A RECORD .  READ INITIAL DEPOT STOCKS(SERV & UNSERV),INITIAL WAR
C RESERVES (SERV & UNSERV) AND IN-PLACE ASL/PLL. SKIP A RECORD.
C READ QUANTITY PER APPLICATION . READ PART DESCRIPTION. READ ASL/PLL
C DEPLOYED AFTER DAY 1. SKIP  3 RECORDS.
C
  500 READ (10,9500,END=1300) Z1,Z2,Z3,Z4,Z5,Z6,Z7,Z8,Z9,IES
      READ (10,9600,END=1300) DSRV,DUNS,WRS,WRU,DAY1
      READ (10,9700,END=1300) IQPA
      READ (10,9800,END=1300) ADSC
      READ (10,9900,END=1300) (PT(K),K=1,24)
      READ (10,9400,END=1300)
C
C DO NOT PROCESS PARTS WITH A AN ESSENTIALITY .GT. IESS
C
      IF (IES.GT.IESS) GO TO 700
      ZT=Z3+ADDOST
      ZXD=2.*ZT+Z7
      Z2C=Z2/100.
      Z4F=Z4/1000000.
      Z5N=Z5/100.
      Z100=IQPA
      Z8B=Z8/100.
      Z9D=Z9/100.
      IF (MOD(NP+I,50).NE.0) GO TO 630
      WRITE (6,10000) CASE
      WRITE (6,10100)
      WRITE (6,10200)
      WRITE (6,10300)
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C
C DO NOT PROCESS PARTS WITH A FAILURE RATE =0.
C
  600 IF (Z4.GE..0000001) GO TO 800
  700 WRITE (6,10400) Z1,ADSC,Z2C,Z3,Z4F,Z5N,Z6,ZXD,Z7,Z8B,Z9D,Z10Q,IES
      I=I+1
      GO TO 500
  800 NP=NP+1
C
C COMPUTE INITIAL STOCK IN THEATER AS SERVICEABLE WAR RESERVE +
C IN-PLACE ASL/PLL
C
      STK(NP)=WRS+DAY1
      BCY(NP)=Z6
      DCY(NP)=0.
      IF (Z5N.GT.0.) DCY(NP)=ZXD
      ZNRT(NP)=Z5N
      CLASS(NP)='  NO SUB'
C
C IF NFS .LT. 0,LABEL THE FULL-SUB PARTS ACCORDING TO THEIR EXCEEDING
C AT LEAST ONE OF THE SCREENING LIMITS
C
      IF (NFS.GE.0) GO TO 900
      CLASS(NP)='FULL SUB'
      IF (BCY(NP).LE.BREPL.AND.DCY(NP).LE.ZDCY.AND.Z4F.LE.FRLIM.AND.ZNRT
     *(NP).LE.ZNRTL) CLASS(NP)='  NO SUB'
      GO TO 1100
  900 IF (NFS.EQ.0) GO TO 1100
      DO 1000 L=1,NFS
        IF (IFS(L).NE.NP) GO TO 1000
        CLASS(NP)='FULL SUB'
        GO TO 1100
 1000 CONTINUE
 1100 WRITE (6,10500) NP,Z1,ADSC,Z2C,Z3,Z4F,Z5N,Z6,ZXD,Z7,Z8B,Z9D,Z10Q,I
     *ES,CLASS(NP),STK(NP)
      OST(NP)=Z7
      AMSN(NP)=Z1
      COST(NP)=Z2C
      FR(NP)=Z4F
      BC(NP)=Z8B
      DC(NP)=Z9D
      QPA(NP)=Z10Q
      ADESC(NP)=ADSC
      DSER(NP)=DSRV
      DUNSER(NP)=DUNS
      WRES(NP)=WRS
      WRESU(NP)=WRU
      DAY1D(NP)=DAY1
      DO 1200 L=1,24
 1200 PTDEP(NP,L)=PT(L)
      IF (NFS.GE.0.OR.CLASS(NP).EQ.'  NO SUB') GO TO 500
C
C IF NFS .LT. 0, STORE THE PART NUMBERS OF THE FULL-SUB PART SET
C  PREVIOUSLY LABELED
C
      NP1=NP1+1
      IFS(NP1)=NP
      GO TO 500
 1300 II=NP+I
      IF (NFS.GE.0) NP1=NFS
      WRITE (6,10600) II,NP
C
C READ COST LIMIT(TOTAL RQMTS),COST LIMIT(ADD-ON RQMTS) AND ITERATION
C LIMIT
C
      READ (11,10700) CLNCR,CLNCT,LIMIT
C
C READ MAX FH/ACFT/DAY,NR DAYS IN WAR,TYPE RQMTS TO CALCULATE,DESIRED
C ORDER OF RQMTS OUTPUT AND VARIOUS PRINT OPTIONS
C
      READ (11,10800) FHM,NW,ISEL,IORD,IOPT1,IOPT2,IOPT3,IOPT4,IOPT5,IPR
     *T,IPRT1
      INT=1
      IF (NP1.EQ.0.OR.IPRT1.LE.0) GO TO 1500
C
C PRINT THE LIST OF FULL-SUB PARTS USED IN THE REQMTS  CASES
C
      DO 1400 I=1,NP1
        II=IFS(I)
        IF (MOD(I-1,50).NE.0) GO TO 1400
        WRITE (6,10000) CASE
        WRITE (6,10900) KNTC
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            WRITE (6,10200)
            WRITE (6,10300)
 1400 WRITE (6,11000) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
     +(II),DCY(II),BC(II),DC(II),STK(II)
 1500 NP2=0
C
C DEFINE THE NO-SUB PART SET (INS(J)) AS ALL PARTS NOT DESIGNATED FOR
C THE FULL-SUB PART SET
C
      DO 1800 K=1,NP
         IF (NP1.EQ.0) GO TO 1700
         DO 1600 I=1,NP1
            IF (IFS(I).EQ.K) GO TO 1800
 1600    CONTINUE
 1700    NP2=NP2+1
         INS(NP2)=K
 1800 CONTINUE
      IF (NP2.EQ.0.OR.IPRT1.LE.0) GO TO 2000
C
C PRINT THE LIST OF NO-SUB PARTS USED IN THE REQMTS CASES
C
      DO 1900 I=1,NP2
         II=INS(I)
         IF (MOD(I-1,50).NE.0) GO TO 1900
         WRITE (6,10000) CASE
         WRITE (6,11100) KNTC
         WRITE (6,10200)
         WRITE (6,10300)
 1900 WRITE (6,11200) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
     +(II),DCY(II),BC(II),DC(II),STK(II)
C
C READ IN THE CUMULATIVE NUMBER OF ACFT DEPLOYED (FOR EACH DAY INTERVAL)
C
 2000 READ (11,9100) NACDEP
      READ (11,9100) (IDAY(I),I=1,NACDEP)
      READ (11,9100) (NAC(I),I=1,NACDEP)
      DO 2200 I=1,NACDEP
         K1=IDAY(I)
         K2=IDAY(I+1)-1
         IF (I.EQ.NACDEP) K2=NW
         DO 2100 J=K1,K2
 2100    AC(J)=NAC(I)
 2200 CONTINUE
C
C READ IN THE PROGRAM FLYING HOURS (FOR EACH DAY INTERVAL)
C
      READ (11,9100) NFHDAY
      READ (11,9100) (IDAY(I),I=1,NFHDAY)
      READ (11,9100) (NFH(I),I=1,NFHDAY)
      DO 2400 I=1,NFHDAY
         K1=IDAY(I)
         K2=IDAY(I+1)-1
         IF (I.EQ.NFHDAY) K2=NW
         DO 2300 J=K1,K2
            FHA(J)=NFH(I)
 2300    FHR(J)=NFH(I)
 2400 CONTINUE
C
C READ IN THE NUMBER OF ACFT LOST(ATTRITION) IN EACH DAY INTERVAL
C
      READ (11,9100) NLDAY
      READ (11,9100) (IDAY(I),I=1,NLDAY)
      READ (11,11300) (ZLOSS(I),I=1,NLDAY)
      DO 2600 I=1,NLDAY
         K1=IDAY(I)
         K2=IDAY(I+1)-1
         IF (I.EQ.NLDAY) K2=NW
         DO 2500 J=K1,K2
 2500    ALR(J)=ZLOSS(I)
 2600 CONTINUE
C
C READ  THE DESIRED MINIMIUM ACFT AVAILABILITY OBJECTIVE FOR EACH DAY INTERVAL
C
      READ (11,9100) NMDAY
      READ (11,9100) (IDAY(I),I=1,NMDAY)
      READ (11,11400) (AM(I),I=1,NMDAY)
      DO 2800 I=1,NMDAY
         K1=IDAY(I)
         K2=IDAY(I+1)-1
         IF (I.EQ.NMDAY) K2=NW
         DO 2700 J=K1,K2
 2700    AVM(J)=AM(I)
```

```
 2800 CONTINUE
C
C READ (UP TO 100) PART NUMBERS OF PARTS SELECTED TO HAVE " CUMUL
C REQMT THRU DAY N" OUTPUT FOR EACH DAY N OF THE SCENARIO
C
      READ (11,9100) IMSEL
      READ (11,9100) (IPT(K),K=1,IMSEL)
      IF (IPRT1.LE.0) GO TO 3300
      ZCOST=0.
C
C THRU STMT 3500,PROCESS ALL PART DEPLOYMENTS
C
      DO 3000 K=1,NP
         SUM=0.
C
C FOR EACH PART,CALCULATE TOTAL ASL/PLL DEPLOYMENTS(SUM),TOTAL
C NON-CONDEMNED PARTS (SUMT) AND VALUE OF ENTIRE CURRENT INVENTORY.
C PRINT SUMMARY PART DEPLOYMENTS FOR EACH PART (IN ORDER OF INPUT)
C
         DO 2900 I=1,24
 2900    SUM=SUM+PTDEP(K,I)
         SUMT=SUM+DSER(K)+DUNSER(K)*(1.-DC(K))+WRES(K)+DAY1D(K)+(1.-ZNRT(
     +   K))*WRESU(K)*(1.-BC(K))+ZNRT(K)*WRESU(K)*(1.-DC(K))
         ZCOST=ZCOST+SUMT*COST(K)
         IF (MOD(K-1,51).NE.0) GO TO 3000
         WRITE (6,10000) CASE
         WRITE (6,11500)
         WRITE (6,10100)
         WRITE (6,10300)
         WRITE (6,11600)
         WRITE (6,10300)
 3000 WRITE (6,11700) K,K,AMSN(K),ADESC(K),COST(K),CLASS(K),DSER(K),DUNS
     +ER(K),WRES(K),WRESU(K),DAY1D(K),SUM,SUMT
      DO 3200 K=1,NP
         IF (MOD((K-1)*3,60).NE.0) GO TO 3100
         WRITE (6,10000) CASE
         WRITE (6,11800)
         WRITE (6,11900)
         WRITE (6,12000)
         WRITE (6,10300)
C
C PRINT THE UNADJUSTED (I.E, ASL/PLL ONLY) PARTS DEPLOYMENT
C
 3100    WRITE (6,12100) K,AMSN(K),ADESC(K)
 3200 WRITE (6,12200) (PTDEP(K,L),L=1,24)
C
C THRU STMT 3500, DISTRIBUTE INITIAL (SERV & UNSERV) DEPOT AND INITIAL
C (SERVICEABLE) WAR RESERVE STOCKS OVER DAYS.   IN EACH DISTRIBUTION
C IFDAY IS FIRST DAY OF RECEIPT, ILDAY IS LAST DAY AND DAMT IS
C AMOUNT RECEIVED PER DAY.
C
 3300 DO 3500 K=1,NP
         IFDAY=DLAG+1
         ILDAY=DLAG+DDIS
         DAMT=DSER(K)/DDIS
C
C INITIAL DEPOT SERVICEABLES ARE DISTRIBUTED
C
         CALL DIST (IFDAY,ILDAY,DAMT,K)
         IFDAY=OST(K)+1.
         DREP=DCY(K)-2.*OST(K)
      X=DREP
         IF (DREP.LT.1.) DREP=1.000
         ILDAY=OST(K)+DREP
         DAMT=((1.-DC(K))*DUNSER(K))/DREP
C
C INITIAL DEPOT UNSERVICEABLES ARE DISTRIBUTED (LESS CONDEMNATIONS)
C
         CALL DIST (IFDAY,ILDAY,DAMT,K)
         AMT=(1.-ZNRT(K))*WRESU(K)*(1.-BC(K))
         IFDAY=1
         IF (BCY(K).LT.1.) BCY(K)=1.
         ILDAY=BCY(K)
         DAMT=AMT/BCY(K)
C
C INITIAL UNSERVICEABLE WAR RESERVES REPAIRED AT RETAIL ARE DISTRIBUTED
C
         CALL DIST (IFDAY,ILDAY,DAMT,K)
         AMT=ZNRT(K)*WRESU(K)*(1.-DC(K))
         IFDAY=1.+2.*OST(K)
         ILDAY=2.*OST(K)+DREP
         DAMT=AMT/DREP
```

```
C
C INITIAL UNSERVICEABLE WAR RESERVES REPAIRED AT DEPOT  ARE DISTRIBUTED
C (INITIAL SERVICEABLE WAR RESERVES,ALREADY IN-PLACE,ARE NOT DISTRIBUTED)
C
            CALL DIST (IFDAY,ILDAY,DAMT,K)
            IF (IPRT1.LE.0) GO TO 3500
            IF (MOD((K-1)*3,60).NE.0) GO TO 3400
            WRITE (6,10000) CASE
            WRITE (6,12300)
            WRITE (6,11900)
            WRITE (6,12000)
            WRITE (6,10300)
C
C WRITE PART ID. IF THE PART  IS AN INITIAL DEPOT UNSERVICEABLE WITH
C A REPAIR TIME=0,PRINT A WARNING
C
 3400       IF (X .GE..0001.OR.DAMT.LE..001) WRITE (6,12100) K,AMSN(K),A
     +      DESC(K)
            IF (X .LT..0001.AND.DAMT.GT..001) WRITE (6,12400) K,AMSN(K),A
     +      DESC(K)
C
C PRINT THE ADJUSTED (INITIAL UNSERVICEABLE DEPOT & WAR RES STKS &
C ASL/PLL DEPLOYED AFTER DAY 1) PARTS DEPLOYMENT (EXCLUDES IN-PLACE
C ASL/PLL AND SERVICEABLE WAR RESERVES)
C
            WRITE (6,12200) (PTDEP(K,L),L=1,24)
 3500 CONTINUE
      IF (IPRT.LE.0) GO TO 3800
C
C PRINT THE SCENARIO INPUT DATA SUMMARY
C
      DO 3700 J=1,NW
         IF (MOD(J-1,51).NE.0) GO TO 3600
         WRITE (6,10000) CASE
         WRITE (6,12500)
         WRITE (6,12600) ADDOST,CONVF,LIMIT,IESS
         WRITE (6,12700) FHM,CLNCR,CLNCT
         WRITE (6,12800) ZCOST
         WRITE (6,12900)
         WRITE (6,13000)
 3600    CALR=CALR+ALR(J)
 3700 WRITE (6,13100) J,AC(J),FHR(J),AVM(J),ALR(J),CALR
 3800 WRITE (6,10000) CASE
      WRITE (6,13200)
C
C PRINT A REPORT SUMMARIZING OPTIONS SELECTED FOR THIS RUN
C
      IF (ISEL.EQ.0) WRITE (6,13300) ISEL
      IF (ISEL.EQ.1) WRITE (6,13400) ISEL
      IF (ISEL.EQ.2) WRITE (6,13500) ISEL
      IF (NFS.LT.0) WRITE (6,13600) NFS,ZDCY,ZNRTL,BREPL,FRLIM
      IF (NFS.GE.0) WRITE (6,13700) NFS
      IF (IORD.LE.0) WRITE (6,13800) IORD
      IF (IORD.GT.0) WRITE (6,13900) IORD
      IF (IOPT1.LE.0) WRITE (6,14000) IOPT1
      IF (IOPT1.GT.0) WRITE (6,14100) IOPT1
      IF (IOPT2.LE.0) WRITE (6,14200) IOPT2
      IF (IOPT2.GT.0) WRITE (6,14300) IOPT2
      IF (IOPT3.LE.0) WRITE (6,14400) IOPT3
      IF (IOPT3.GT.0) WRITE (6,14500) IOPT3
      IF (IOPT4.LE.0) WRITE (6,14600) IOPT4
      IF (IOPT4.GT.0) WRITE (6,14700) IOPT4
      IF (IOPT5.LE.0) WRITE (6,14800) IOPT5
      IF (IOPT5.GT.0) WRITE (6,14900) IOPT5
      IF (IPRT.LE.0) WRITE (6,15000) IPRT
      IF (IPRT.GT.0) WRITE (6,15100) IPRT
      IF (IPRT1.LE.0) WRITE (6,15200) IPRT1
      IF (IPRT1.GT.0) WRITE (6,15300) IPRT1
      WRITE (6,15400) INT,INT
      DO 3900 I=1,NW
 3900 DCOSTF(I)=0.
      DO 4000 I=1,NP
 4000 DOD(I)=COST(I)
      KNT=0
C
C ORDER THE NO-SUB PART SET ACCORDING TO DECREASING UNIT COST (MOST
C EXPENSIVE PART FIRST)
C
      NDUMMY=NP
      DO 4300 K=1,NP
         CALL MAXC (NDUMMY,NOUT)
         IRC(K)=NOUT
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            II=IRC(K)
            IF (NP1.LE.0) GO TO 4200
            DO 4100 L=1,NP1
               IF (IFS(L).EQ.II) GO TO 4300
 4100       CONTINUE
 4200       KNT=KNT+1
            INS(KNT)=II
 4300 DOD(II)=-1.
         IF (IPRT1.LE.0) GO TO 4600
C
C PRINT SUMMARY PART DEPLOYMENTS FOR EACH PART (IN ORDER OF UNIT COST)
C
         DO 4500 K=1,NP
            II=IRC(K)
            IF (MOD(K-1,51).NE.0) GO TO 4500
            WRITE (6,10000) CASE
            WRITE (6,15500)
            WRITE (6,10300)
            WRITE (6,11650)
            WRITE (6,10300)
 4500 WRITE (6,11700) K,II,AMSN(II),ADESC(II),COST(II),CLASS(II)
 4600 CALR=0.
C
C COMPUTETHE MINIMUM NUMBER OF ACFT(ALLOWB(I)) REQUIRED TO MEET THE FLYING
C PROGRAM/AVAILABILITY OBJECTIVE FOR EACH DAY I
C
         WRITE (6,15600)
         DO 4700 I=1,NW
            CALR=CALR+ALR(I)
            ASURV(I)=AC(I)-CALR
            XX=AMAX1(0.,ASURV(I)*(1.-AVM(I)))
            YY=AMAX1(0.,ASURV(I)-FHR(I)/FHM)
            ALLOWB(I)=AMIN1(XX,YY)
            IF (ALLOWB(I).EQ.YY) IFHC(I)=0
            IF (ALLOWB(I).EQ.XX) IFHC(I)=1
 4700 CONTINUE
         TTFH=0.000001
C
C COMPUTE TOTAL FLYING HOURS IN THE FULL FLYING PROGRAM
C
         DO 4800 I=1,NW
 4800 TTFH=TTFH+FHR(I)
C
C COMPUTE COEFFICIENTS USED BY FUNCTION SR IN THE CALCULATION OF
C NET DEMAND
C
         DO 4900 J=1,NP
            CF(J)=FR(J)*QPA(J)
            BF(J)=(1.-BC(J))*(1.-ZNRT(J))*CF(J)
            DF(J)=(1.-DC(J))*(ZNRT(J))*CF(J)
 4900 CONTINUE
C
C IF ONLY ASSESSMENT CASES ARE TO BE PROCESSED,SKIP REQMT CALCULATIONS
C
         IF (IOPT1.LE.0) GO TO 7600
         IND1=1
         IND2=2
C
C DETERMINE WHETHER ONLY RESIDUAL RQMTS(ISEL=0),ONLY TOTAL RQMTS(ISEL=1),
C OR BOTH RESIDUAL AND TOTAL RQMTS(ISEL=2) ARE TO BE DONE IN THIS RUN
C
         IF (ISEL.EQ.2) GO TO 5000
         IND1=1+ISEL
         IND2=1+ISEL
C
C THRU STMT 7500 PROCESS ALL REQUIREMENTS CALCULATIONS AND ASSOCIATED
C CAPABILITY ASSESSMENTTS FOR BOTH UNCONSTRAINED COST AND CONSTRAINED
C COST CASES
C
 5000 DO 7500 IND=IND1,IND2
            ACL=0.
            CL=CLNCT
            ICOST=0
            IF (IND.EQ.2) CL=CLNCR
C
C CALL SUBROUTINE UCRQPS TO COMPUTE THE UNCONSTRAINED COST REQMTS
C SOLUTION. THEN CALL SUBROUTINF UCCAP TO GENERATE THE CAPABILITY
C ASSESSMENT BASED ON THE UNCONSTRAINED COST SOLUTION
C
            CALL UCRQPS (IND,IOPT4,IOPT5,IORD)
            CALL UCCAP (IND)
C
```

```
C  FOLLOWING  STMTS THRU STMT 7600 PROCESS THE CONSTRAINED COST CASE.
C IF THE COST LIMIT (CL) IS NEGATIVE,OMIT CONSTRAINED COST PROCESSING
C
        IF (CL.LE.0.) GO TO 7500
        IW=NW
        UCNS=0.                                                              NEW
        FRAC1=0.
C
C IF THIS IS A FULL SUB CASE ,OMIT CONSTR COST ALGORITHM 1 AND ONLY
C PROCESS CONSTR COST ALGORITHM 2
C
        IF (NP2.EQ.0) GO TO 6600
C
C UP TO STMT 6600 PROCESS THE CONSTR COST SOLUTION FOR ALGORITHM 1
C
C
C RECOMPUTE THE COST OF THE UNCONSTR COST SOLUTION
C
        DO 5100 J=1,NP2
          II=INS(J)
 5100   UCNS=UCNS+COST(II)*RNCS(II)
        WRITE (5,10000) CASE
        WRITE (6,15700)
C
C SAVE THE UNCONSTR COST SOLUTION IN AN ARRAY
C
        DO 5200 J=1,NP
 5200   TRNCS(J)=RNCS(J)
C
C THRU STMT 5800,THE STANDARD PARCOM NO-SUB CONSTR COST ALGORITHM
C OPERATES ON THE NO-SUB PART SET.
C
        CL1=CL
        CNC=CMINT-CL
C
C CNC IS THE $ AMOUNT OF THE UNCONSTR COST SOLUTION WHICH IS NOT AFFORDABLE
C AND SO MUST BE 'UNBOUGHT'. IF CNC .LT. 0,THEN THE UNCONSTR COST
C SOLUTION IS ALSO THE CONSTR COST SOLUTION
C
        IF (CNC.GT.0.) GO TO 5300
        IF (IND.EQ.1) WRITE (6,15800)
        IF (IND.EQ.2) WRITE (6,15900)
        GO TO 7500
C
C UNDER ALGORITHM 1 LOGIC,THE NO-SUB PART SET REQMT IS 'BOUGHT' FIRST
C (OR,EQUIVALENTLY, THE FULL-SUB SET REQMT IS 'UNBOUGHT' FIRST').
C IF CNC .LT. THE COST OF THE FULL-SUB PARTS IN THE UNCONSTR COST
C SOLUTION (DCOST1(NW)),THEN THE ENTIRE UNCONSTR COST NO-SUB REQMT
C IS 'BOUGHT AND PART OF THE UNCONSTR COST FULL-SUB REQMT MUST BE
C 'UNBOUGHT', OTHERWISE THE ENTIRE UNCONSTR COST FULL-SUB REQMT IS
C 'UNBOUGHT' AND ONLY PART OF THE NO-SUB REQMT MUST BE 'BOUGHT'.
C
 5300   IF (CNC.GT.DCOST1(NW)) GO TO 5400
        CL1=UCNS
        CL2=CL-CL1
        GO TO 5900
 5400   IF (NP1.EQ.0) GO TO 5600
C
C BEFORE STARTING ALGORITHM 1 PROCESSING,INITIALIZE FULL-SUB REQUIREMENTS TO 0
C
        DO 5500 J=1,NP1
          II=IFS(J)
 5500    RNCS(II)=0.                                                         NEW
C
C TRNCS STORES THE NO-SUB PARTS MIX PORTION OF THE SOLUTION FOR
C ALGORITHM 1
C
 5600   CL2=0.
        CL1=CL-CL2
        CNC=UCNS-CL1
        DO 5800 J=1,NP2
          II=INS(J)
          C=TRNCS(II)*COST(II)
          IF (C.LT.CNC) GO TO 5700
          TRNCS(II)=TRNCS(II)-CNC/COST(II)
          IW=NW
          GO TO 6200
 5700     TRNCS(II)=0.
          CNC=CNC-C
 5800   CONTINUE
        GO TO 6100
 5900   IFCC=1
```

```
C
C DETERMINE IFCC,THE LAST DAY N FOR WHICH 'CUM FULL-SUB REQMT COST
C THRU DAY N' IS .LE. CL2(THE AFFORDABLE AMOUNT OF FULL-SUB PARTS)
C
      DO 6000 I=1,NW
        IF (DCOST1(I).GT.CL2) GO TO 6000
        IFCC=I
        BCL=DCOST1(I)
 6000 CONTINUE
      WRITE (6,16000)
 6100 IF (CL2.GE.DCOST1(NW)) WRITE (6,16100)
      IF (CL2.LT.DCOST1(NW)) WRITE (6,16200) CL2,BCL,IFCC
      IW=NW
      NW=IFCC
C
C GENERATE THE FULL-SUB PARTS MIX ASSOCIATED WITH DAY IFCC
C
      CALL UCPQPS (IND,IOPT4,IOPT5,IORD)
 6200 WRITE (6,16300) CL,CL1
      WRITE (6,10300)
      IF (CL2.LE..0001) WRITE (6,16400)
      NW=IW
C
C MERGE THE JUST-COMPUTED FULL-SUB MIX(SUSTAINABILITY SOLUTION)
C JUST COMPUTED WITH THE NO-SUB MIX 'BOUGHT' EARLIER AND STORE
C THIS COMBINED SOLUTION (FOR CONSTR COST ALGORITHM 1) IN TRNCS
C
      DO 6300 I=1,NP2
        II=INS(I)
 6300 RNCS(II)=TRNCS(II)
      DO 6400 I=1,NP
 6400 TRNCS(I)=RNCS(I)
      TOT=0.
      DO 6500 I=1,NP
        TOT=TOT+COST(I)*RNCS(I)
 6500 RNCS(I)=RNCS(I)+STK(I)*(IND-1)
      IP=0
C
C CALL THE CAPABILITY ASSESSMENT ROUTINE (BUT DON'T PRINT RESULTS)
C TO COMPUTE FNC,THE FRACTION FRACTION OF THE FLYING PROGRAM ACHIEVED
C USING THE ALGORITHM 1 SOLUTION
C
      CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)                NEW
      FRAC1=FNC
      WRITE (6,16500) FRAC1
C
C THRU STMT 6800,GENERATE THE SOLUTION FOR CONSTR COST ALGORITHM 2.
C STORE THAT SOLUTION IN ARRAY XRNCS.
C SUBROUTINE UCRQPS HAS ALREADY DETERMINED IDCC(IND),THE LAST DAY N
C FOR WHICH 'CUM TOTAL(I.E. ALL PARTS) REQMT COST THRU DAY N'
C IS .LE. CL,THE (INPUT) COST LIMIT.
C
 6600 IF (IDCC(IND).LE.1.OR.IDCC(IND).GE.NW) GO TO 7500
      NW=IDCC(IND)
      DO 6700 I=1,NW
 6700 FHA(I)=FHR(I)
      CALL UCRQPS (IND,IOPT4,IOPT5,IORD)
      DO 6800 J=1,NP
        XRNCS(J)=RNCS(J)
        NW=IW
        IP=0
 6800 RNCS(J)=RNCS(J)+STK(J)*(IND-1)
C
C CALL THE CAPABILITY ASSESSMENT ALGORITHM TO  COMPUTE THE FRACTION
C FLYING PROGRAM COMPLETED WITH THE ALGORITHM 2 SOLUTION(BUT DON'T PRINT IT)
C
      CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
      FRAC2=FNC
      WRITE (6,16600) FRAC2
C
C CHOOSE THE CONSTR COST ALGORITHM SOLUTION  WHICH GIVES THE HIGHER
C FRACTION FLYING PROGRAM ACHIEVED AND CALL SUBROUTINE CCLIST TO PRINT
C THE SELECTED SOLUTION
C
      IF (FRAC1.LE.FRAC2) GO TO 7100
      DO 6900 J=1,NP
 6900 RNCS(J)=TRNCS(J)
      IG=1
      ACL=TOT
      CALL CCLIST (IG,IORD,IND)
      DO 7000 J=1,NP
 7000 RNCS(J)=TRNCS(J)+STK(J)*(IND-1)
```

```
            IP=1
            CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
            GO TO 7400
 7100       IG=2
            DO 7200 J=1,NP
 7200       RNCS(J)=XRNCS(J)
            CALL CCLIST (IG,IORD,IND)
            DO 7300 J=1,NP
 7300       RNCS(J)=XRNCS(J)+STK(J)*(IND-1)
            IP=1
C
C CALL THE CAPABILITY ASSESSMENT ALGORITHM AGAIN TO PRINT OUT ASSESSMENT
C RESULTS FOR THE SELECTED CONSTR COST SOLUTION
C
            CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
 7400       NW=IW
        DO 7450 I=1,NW                                                  NEW
 7450 FHA(I)=FHR(I)                                                     NEW
 7500 ICOST=0
C
C THRU STMT 8900 DO CAPABILITY ASSESSMENT OF 'CURRENT INVENTORY'
C UNDER VARIOUS PARTIAL-SUB POLICIES
C
 7600 DO 7700 K=1,NP
 7700 RNCS(K)=STK(K)
        IP=1
        IND=2
C
C DO A CAPABILITY ASSESSMENT FOR THE PART-SUB POLICY USED IN THE
C REQMTS CALCULATIONS
C
        CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
        KNTC=2
C
C RESET STOCK TO INITIAL LEVELS AND CLEAR FULL-SUB AND NO-SUB PART
C ARRAYS PRIOR TO RESETTING THEM(FOR A NEW PART-SUB POLICY)
C
 7800 DO 7900 K=1,NP
          RNCS(K)=STK(K)
          INS(K)=0
 7900 IFS(K)=0
C
C READ ANOTHER PART-SUB POLICY IN TERMS OF EITHER THE NR & DESIGNATION
C OF FULL-SUB PARTS(IF NPTFS .GT. 0) OR ELSE THE NR & DESIGNATION
C OF OF NO-SUB PARTS (IF NPTNS .GT.0). ONLY ONE SET IS READ.
C
        READ (11,9100,END=16700) NPTFS,NPTNS
        IF ((NPTFS+NPTNS).LE.0) GO TO 16700
        IF (NPTFS.LE.0) GO TO 8200
C
C READ IN THE DESIGNATED FULL-SUB PARTS FOR THIS POLICY. ALL OTHER
C PARTS ARE,BY DEFAULT, NO-SUB PARTS.
C
        NP1=NPTFS
        READ (11,9100) (IFS(I),I=1,NPTFS)
        NP2=0
        DO 8100 K=1,NP
          DO 8000 I=1,NP1
            IF (IFS(I).EQ.K) GO TO 8100
 8000     CONTINUE
          NP2=NP2+1
          INS(NP2)=K
 8100 CONTINUE
        GO TO 8500
 8200 NP2=NPTNS
C
C READ IN THE DESIGNATED NO-SUB PARTS FOR THIS POLICY. ALL OTHER
C PARTS ARE,BY DEFAULT, FULL-SUB PARTS.
C
        READ (11,9100) (INS(I),I=1,NPTNS)
        NP1=0
        DO 8400 K=1,NP
          DO 8300 I=1,NP2
            IF (INS(I).EQ.K) GO TO 8400
 8300     CONTINUE
          NP1=NP1+1
          IFS(NP1)=K
 8400 CONTINUE
 8500 IF (IOPT2.LE.0) GO TO 8700
C
C PRINT THE COMPOSITION OF THE FULL-SUB PART SET FOR THIS PART-SUB
C POLICY
```

```
      C
            DO 8600 I=1,NP1
              II=IFS(I)
              IF (MOD(I-1,50).NE.0) GO TO 8600
              WRITE (6,10000) CASE
              WRITE (6,10900) KNTC
              WRITE (6,10200)
              WRITE (6,10300)
       8600 WRITE (6,11000) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
           +(II),DCY(II),BC(II),DC(II),STK(II)
       8700 IF (IOPT3.LE.0) GO TO 8900
      C
      C PRINT THE COMPOSITION OF THE NO-SUB PART SET FOR THIS PART-SUB
      C POLICY
      C
            DO 8800 I=1,NP2
              II=INS(I)
              IF (MOD(I-1,50).NE.0) GO TO 8800
              WRITE (6,10000) CASE
              WRITE (6,11100) KNTC
              WRITE (6,10200)
              WRITE (6,10300)
       8800 WRITE (6,11200) II,AMSN(II),ADESC(II),COST(II),FR(II),ZNRT(II),BCY
           +(II),DCY(II),BC(II),DC(II),STK(II)
              IND=2
      C
      C COMPUTE AND PRINT CAPABILITY ASSESSMENT RESULTS FOR 'CURRENT INVENTORY'
      C WITH THE NEW PART-SUB POLICY
      C
       8900 CALL CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
            KNTC=KNTC+1
      C
      C GO BACK AND PROCESS ANOTHER PART-SUB POLICY FOR USE IN CAPABILITY
      C ASSESSMENT
      C
            GO TO 7800
       9000 FORMAT (2F5.2,I5,2F5.0)
       9100 FORMAT (16I5)
       9200 FORMAT (F5.0,F5.3,F5.0,F10.6)
       9300 FORMAT (1X,A16)
       9400 FORMAT (//)
       9500 FORMAT (2X,A15,F9.0,5X,F3.0,F5.0,5F3.0,I1,10X,I5)
       9600 FORMAT (/,5F6.0,/)
       9700 FORMAT (I2)
       9800 FORMAT (A16)
       9900 FORMAT (10F10.0)
      10000 FORMAT (1H1,30X,'CASE= ',A16)
      10100 FORMAT (//,' ITEMS RANK ORDERED IN NORMAL INPUT ORDER')
      10200 FORMAT (/,' PART',5X,'MSN',14X,'DESCRIPTION',7X,' COST OST FAIL',' 
           + RT NRTS  BCY   DCY  DRT BC3N DCON QPA  ESS     CLASS  INIT STK')
      10300 FORMAT (/)
      10400 FORMAT (9X,A16,2X,A16,F8.0,F3.0,F8.6,F5.2,3F5.0,2F5.2,1X,F3.0,I5,1
           +0X,I10)
      10500 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,F3.0,F8.6,F5.2,3F5.0,2F5.2,1X,F3.
           +0,I5,1X,A8,F10.1)
      10600 FORMAT (' TOTAL NR PARTS=',I4,'    NR USED=',I4)
      10700 FORMAT (1X,F14.0,F15.0,I5)
      10800 FORMAT (1X,F9.1,I5,5X,10I5)
      10900 FORMAT (//,' FULL SUB ITEMS FOR POLICY',I3)
      11000 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,3X,F8.6,F5.2,2F5.0,5X,2F5.2,1X,10
           +X,'FULL SUB',F10.0)
      11100 FORMAT (//,'    NO SUB ITEMS FOR POLICY',I3)
      11200 FORMAT (1X,I4,4X,A16,2X,A16,F8.0,3X,F8.6,F5.2,2F5.0,5X,2F5.2,1X,10
           +X,'   NO SUB',F10.0)
      11300 FORMAT (16F5.1)
      11400 FORMAT (16F5.2)
      11500 FORMAT (/,104X,' DEPLOYED')
      11600 FORMAT (' RANK PART',8X,'MSN',18X,'DESCRIPTION',13X,'COST','     CL
           +ASS',2X,'DSERV DUNSR WRSRV WRUNS  DAY1  DAY2- TOT NC')
      11650 FORMAT (' RANK PART',8X,'MSN',18X,'DESCRIPTION',13X,'COST')
      11700 FORMAT (2I5,5X,A16,5X,A16,1X,F14.0,1X,A8,1X,5F6.0,2F7.0)
      11800 FORMAT (//,' UNADJUSTED PARTS DEPLOYMENT BY DAY INTERVAL')
      11900 FORMAT (/,'      -5   -10   -15   -20   -25   -30   -35   -40   -45'
           +,'   -50   -55   -60   -65   -70   -75   -80   -85   -90   -95','
           + -100')
      12000 FORMAT ('  -105  -110  -115  -120')
      12100 FORMAT (I5,2X,A16,2X,A16)
      12200 FORMAT (1X,20F6.0)
      12300 FORMAT (//,' ADJUSTED (FOR DEPOT STKS) PARTS DEPLOYED BY INTERVAL'
           +)
      12400 FORMAT (I5,2X,A16,2X,A16,3X,'* WARNING* DEPOT UNSERV STK W/ DEP','
           +OT REPAIR TIME=0 (CHGED TO 1)')
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```
12500 FORMAT (//,10X,'SCENARIO INPUT DATA SUMMARY')
12600 FORMAT (//,5X,'OST OFFSET=',F6.1,' DAYS    DESIPED CONVERGECE=',F5
     +.3,//,3X,'MAX ITERATIONS=',I3,3X,'MAX ESSENTIALITY=',I3)
12700 FORMAT (/,5X,'  MAX FLY HRS/ACFT/DAY=',F5.1,4X,'ADD-ON COST LI','M
     +IT=',F12.0,//,1X,'TOTAL(INIT INV=0) RQMT COST LIMIT=',F13.0)
12800 FORMAT (/,5X,' COST OF CURRENT INVENTORY=',F14.0)
12900 FORMAT (/,13X,'CUM ACFT   PROGRAM   MIN REQ    ACFT   CUM ACFT')
13000 FORMAT (7X,'DAY   DEPLOYED   FLY HRS     AVAIL    LOST',7X,'LOST')
13100 FORMAT (5X,I5,F11.0,F10.0,F10.2,F8.1,F11.1)
13200 FORMAT (//,10X,' ******  OPTIONS CHOSEN FOR THIS RUN ******')
13300 FORMAT (////,5X,'ISEL=',I3,'  ** ONLY THE TOTAL(INIT STK=0)',' RQM
     +TS ARE COMPJTED IN THIS RUN  ')
13400 FORMAT (////,5X,'ISEL=',I3,'  ** ONLY THE RESIDUAL(INIT STK=CURR',
     +' INV) RQMTS ARE COMPUTED IN THIS RUN   ')
13500 FORMAT (////,5X,'ISEL=',I3,'  ** BOTH THE TOTAL(INIT STK=0) AND''
     +RESIDUAL(INIT STK=CURR INV) RQMTS ARE IN THIS RUN **')
13600 FORMAT (//,5X,'NFS=',I3,'  ** FULL SUB SET IS CHOSEN ACCORDING','
     +TO A DEPOT REPAIR CYCLE EXCEEDING',F12.0,' DAYS OR NRTS ','EXCEEDI
     +NG',F6.3,/,15X,'OR RETAIL REPAIR TIME  EXCEEDING',F8.0,'  OR FAILU
     +RE RATE EXCEEDING',F9.6)
13700 FORMAT (//,5X,'NFS=',I3,'  ** FULL SUB SET IS SPECIFIED BY INPUT')
13800 FORMAT (//,5X,'IORD=',I3,'  ** COMPUTED RQMTS LISTS WILL BE IN ','
     +ORDER OF DECREASING UNIT COST OF PART')
13900 FORMAT (//,5X,'IOPD=',I3,'  ** COMPUTED RQMTS LISTS WILL BE IN ','
     +ORDER OF DECREASING RQMT AMOUNT FOR PART')
14000 FORMAT (//,5X,'IOPT1=',I3,'  ** ONLY ASSESSMENT CASES WILL BE ','D
     +ONE IN THIS RUN')
14100 FORMAT (//,5X,'IOPT1=',I3,'  ** BOTH ASSESSMENT AND RQMT CASES','
     +WILL BE DONE IN THIS RUN')
14200 FORMAT (//,5X,'IOPT2=',I3,'  ** THE FULL SUB PART SETS USED IN','
     +ASSESSMENT CASES WILL NOT BE PRINTED')
14300 FORMAT (//,5X,'IOPT2=',I3,'  ** THE FULL SUB PART SETS USED IN','
     +ASSFSSMENT CASES WILL  BE PRINTED')
14400 FORMAT (//,5X,'IOPT3=',I3,'  ** THE NO SUB PART SETS USED IN',' AS
     +SESSMENT CASES WILL NOT BE PRINTED')
14500 FORMAT (//,5X,'IOPT3=',I3,'  ** THE NO SUB PART SETS USED IN',' AS
     +SESSMENT CASES WILL  BE PRINTED')
14600 FORMAT (//,5X,'IOPT4=',I3,'  ** THE UNCONSTR COST RQMTS LISTS',' W
     +ILL NOT BE PRINTED(BUT ARE COMPUTED)')
14700 FORMAT (//,5X,'IOPT4=',I3,'  ** THE UNCONSTR COST RQMTS LISTS',' W
     +ILL  BE PRINTED ')
14800 FORMAT (//,5X,'IOPT5=',I3,'  ** THE CUM RQMT BY DAY COST LISTS','
     +WILL NOT BE PRINTED ')
14900 FORMAT (//,5X,'IOPT5=',I3,'  ** THE CUM RQMT BY DAY COST LISTS','
     +WILL  BE PRINTED ')
15000 FORMAT (//,5X,'IPRT=',I3,'  ** THE SCENARIO INPUT DATA SUMMARY','
     +WILL NOT BE PRINTED ')
15100 FORMAT (//,5X,'IPRT=',I3,'  ** THE SCENARIO INPUT DATA SUMMARY','
     +WILL  BE PRINTED ')
15200 FORMAT (//,5X,'IPRT1=',I3,'  ** THE FULL SUB AND NO SUB PART ',' S
     +ETS (FOR RQMT CASES) WILL NOT BE PRINTED',/,13X,'NOR WILL ','THE I
     +NPUT-ORDERED AND COST-ORDERED PARTS INPUT LISTS ')
15300 FORMAT (//,5X,'IPRT1=',I3,'  ** THE FULL SUB AND NO SUB PART ',' S
     +ETS (FOR RQMT CASES) WILL BE PRINTED',/,13X,'AS WILL ','THE INPUT-
     +ORDFRED AND COST-ORDERED PARTS INPUT LISTS ')
15400 FORMAT (//,5X,'INT=',I3,'  ** THE PARTIAL SUB RQMT ALGORITHM',' WI
     +LL TEST AT INTERVALS OF ',I3,' (ALLOWABLE NMCS ACFT) ')
15500 FORMAT (/,' ITEMS RANK ORDERED BY  DECREASING PART COST')
15600 FORMAT (1H1)
15700 FORMAT (//,20X,'*** CONSTRAINED COST SOLUTION EVALUATION',' REPORT
     + ***',///)
15800 FORMAT (1H1,//,10X,'THE UNCONSTR COST TOTAL RQMT SOLUTION IS',' AL
     +SO THE CONSTR COST TOTAL RQMT SOLUTION')
15900 FORMAT (1H1,//,10X,'THE UNCONSTR COST RESIDUAL RQMT SOLUTION IS','
     + ALSO THE CONSTR COST RESIDUAL RQMT SOLUTION')
16000 FORMAT (//,10X,'ALL (NO SUB)  PARTS ARE AFFORDABLE IN CONSTRAINED'
     +,' COST SOLUTION I')
16100 FORMAT (//,10X,'ALL FULL SUB  PARTS ARE AFFORDABLE IN CONSTRAINED'
     +,' COST SOLUTION I')
16200 FORMAT (//,5X,F12.0,3X,'APPROXIMATED BY',F12.0,'  CUM FULL SUB','
     +PART COST THRU DAY',I4,'  IS USED TO BUY FULL SUB PARTS')
16300 FORMAT (//,10X,'CONSTR COST LIMIT=',F12.0,3X,'OF WHICH',F12.0,3X,'
     +CAN BE USED',//,10X,'TO BUY (NO SUB) PARTS FROM THE UNCONSTR',
     +' COST SOLUTION')
16400 FORMAT (//,10X,'NO  FULL SUB  PARTS ARE AFFORDABLE IN CONSTRAINED'
     +,' COST SOLUTION I')
16500 FORMAT (//,5X,'THE FIRST CONSTR COST SOL YIELDS AN AVG FRAC',' PGM
     + FLY HRS ACH=',F5.3)
16600 FORMAT (//,5X,'THE 2ND(SUSTNBLTY) CONSTR COST SOL YIELDS AN',' AVG
     + FRAC FH ACH=',F5.3)
16700 END
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# SUBROUTINE CCCAP

```
      SUBROUTINE CCCAP (IND,LIMIT,CONVF,TTFH,KNTC,IP,FNC)
C NAME: CCCAP                 TYPE: SUBROUTINE
C
C PURPOSE: THE CCCAP  (CONSTRAINED COST CAPABILITY ASSESSMENT) SUBROUTINE
C COMPUTES FLEET CAPABILITY ASSESSMENT (AVG AVAILABILITY,FRACTION FLYING
C PROGRAM ACHIEVED,PGM FLYING HRS /ACFT/DAY ) BASED ON THE CONSTRAINED COST
C SOLUTION BEING STOCKED IN THE WAR RESERVE
C
C CALLED BY: MAIN PROGRAM
C
C CALLS
C     -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
C                   FOR A SPECIFIED PART
C
C FILES USED : INPUT - NONE
C              OUTPUT - UNIT 6 (PRINT)
C
C
C ARGUMENTS
C
C
C NAME                     TYPE          DESCRIPTION
C
C
C IND                      FIXED   INDICATOR OF WHETHER TOTAL(INIT STK=0) OR
C                                  RESIDUAL(INIT STK='CURRENT INVENTORY') REQMTS
C                                  ARE BEING PROCESSED .IND=1 INDICATES TOTAL
C                                  REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
C
C LIMIT                    FIXED   THE MAXIMUM NUMBER OF ITERATIONS (PER DAY)
C                                  WHICH THE CONSTRAINED COST CAPABILITY
C                                  ASSESSMENT ALGORITHM (SUBROUTINE CCCAP)
C                                  WILL PERFORM BEFORE IT TERMINATES
C
C CONVF                    REAL    THE CONVERGENCE THRESHOLD (INPUT) USED IN THE
C                                  CAPABILITY ASSESSMENT WITH CONSTRAINED COST OR
C                                  WITH 'CURRENT INVENTORY'
C
C TTFH                     REAL    TOTAL FLYING HOURS IN THE FULL SCENARIO
C                                  FLYING PROGRAM
C
C KNTC                     FIXED   THE PARTIAL-SUB POLICY BEING PROCESSED. KNTC=1
C                                  IS THE POLICY USED IN REQMTS CALCULATIONS AND
C                                  IN THE 1ST 'CURRENT INVENTORY' CAPABILITY
C                                  ASSESSMENT. KNTC=2,3... ARE ADDITIONAL POLICIES
C                                  (INPUT) USED ONLY IN CAPABILITY ASSESSMENTS
C                                  OF CURRENT INVENTORY
C
C IP                       FIXED   INDICATOR TELLING THE CONSTR COST CAPABILITY
C                                  ASSESSMENT ROUTINE (CCCAP) WHETHER TO PRINT THE
C                                  AMOUNT OF SOLUTION REQMT. THIS IS SET BY THE
C                                  MAIN PROGRAM.
C
C FNC                      REAL    FRACTION OF FLEET FLYING HR PROGRAM (FULL WAR)
C                                  WHICH CAN BE ACHIEVED WITH THE CONSTR COST
C                                  SOLUTION INVENTORY OR WITH 'CURRENT INVENTORY'
C
C
C
C LOCAL ARRAYS
C
C
C NAME      DIMENSION   TYPE             DESCRIPTION
C
C DMDT(J)         300   REAL     WORKING VARIABLE USED IN THE CALC OF NET DEMAND
C                                FOR PART J ON DAY I DURING ITERATIONS(TO COMPUTE
C                                ACHIEVED FLYING HRS) FOR EACH DAY
C
C FHNC(I)         120   REAL     NUMBER OF ACHIEVED PROGRAM FLYING HRS ON DAY I
C
C FHNZ(I)         120   REAL     FRACTION OF PROGRAM FLYING HRS WHICH ARE ACHIEVED
C                                ON DAY I
C
C
C COMMON BLOCK (UNLABELED) ENTRIES
C
C
C NAME      DIMENSION   TYPE             DESCRIPTION
C
C
C AC(I)           120   REAL     NR  ACFT DEPLOYED ON DAY I
```

```
C
C ALLOWB(I)          120  REAL     MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
C                                   WILL STILL ALLOW ACHIEVMENT OF CASE OBJECTIVE
C                                   (FLYING HOUR AND AVAILABILITY) ON DAY I
C
C ASURV(I)           120  REAL     NR AC SURVIVING (NOT ATTRITTED)ON DAY I
C
C AVAVG(K)             6  REAL     AVAVG(1)=AVG ACFT AVAIL ,FROM CAPABILITY
C                                   ASSESSMENT,BASED ON STOCKAGE OF EITHER
C                                   CURR INV OR ( CURR INV + COMPUTED ADD-ON
C                                   REQMTS SOLUTION)
C
C                                   AVAVG(2)=AVG MIN ACFT REQ'D TO ACHIEVE
C                                   THE FLYING HR/AVAILABILITY OBJECTIVE.
C
C                                   AVAVG(3)=AVG FLY HR/AVAIL ACFT / DAY
C                                   ,FROM CAPABILITY ASSESSMENT, BASED ON
C                                   EITHER CURR INV OR (CURR INV + THE SOLUTION
C                                   REQMT) BEING STOCKED.
C
C
C CASE                     CHAR     CASE ID
C
C CL                   1  REAL     THE COST LIMIT (AS SPECIFIED  BY INPUT) USED
C                                   IN THE CONSTRAINED COST REQMTS CASE.
C
C DMD(J)             300  REAL     WORKING VARIABLE USED  IN CALCULATION OF
C                                   NET DEMAND(SR(I,J,..)) FOR PART J ON DAY I
C                                   DURING CAPABILITY ASSESSMENT.
C                                   WHEN (CUM)NET DMD THRU DAY I IS BEING
C                                   CALCULATED,DMD(J) IS (CUM) NET DMD THRU THE
C                                   PREVIOUS DAY,BASED ON AN INITIAL STK=0.
C
C DOD(J)             300  REAL     ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
C                                   IN SUBROUTINE MAXC. IN MAIN PGM,THIS HAS PART
C                                   UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
C                                   UCROPS,THIS HAS THE AMOUNT OF THE SOLUTION
C                                   REQMT FOR PART J.
C
C FHA(I)             120  REAL     DURING THE CONSTR COST CAPABILITY ASSESSMENT
C                                   (SUBROUTINE CCAPS) THIS IS THE INITIAL ESTIMATE
C                                   FOR FLYING HRS ACHIEVED ON DAY I WHEN
C                                   EITHER CURR INV OR (CURR INV + COMPUTED
C                                   CONSTRAINED COST ADD-ON REQMT)  IS STOCKED.
C                                   THIS IS RECURSIVELY COMPUTED.
C
C FHM                      REAL     MAXIMUM FLYING HRS PER ACFT PER DAY(INPUT)
C
C FHPAPO(K,I)      3,120  REAL     FHPAPO(1,I)=FLYING HRS PER AVAILABLE ACFT PER
C                                   FOR DAY I UNDER THE SPECIFIED REPLACEMENT
C                                   POLICY BASED ON STOCKING (CURRENT INV +
C                                   THE UNCONSTRAINED COST SOLUTION)
C
C
C                                   FHPAPO(3,I)=FLYING HRS PER AVAILABLE ACFT PER
C                                   FOR DAY I UNDER THE SPECIFIED REPLACEMENT
C                                   POLICY STOCKING EITHER CURRENT INVENTORY OR
C                                   (CURR INV + THE CONSTRAINED COST SOLUTION)
C
C FHR(I)             120  REAL     FLEET PROGRAM FLYING HOURS REQUIRED ON DAY I
C                                   (ACCORDING TO THE INPUT FLYING HR PROGRAM)
C
C ICOST                1  FIXED    INDICATOR WHICH TELLS SUBROUTINE UCROPS WHETHER
C                                   TO PRINT THE PARTS REQMTS LIST (0=DO 1=DON'T).
C                                   REQMTS LIST IS NOT PRINTED DURING CONSTRAINED
C                                   COST REQMT CALCULATIONS.
C
C IFS(J)             300  FIXED    ARRAY STORING THE PARCOM PART NUMBERS OF THE
C                                   PARTS IN THE FULL-SUB PART SET.
C
C INS(J)             300  FIXED    ARRAY STORING THE PARCOM PART NUMBERS OF THE
C                                   PARTS IN THE NO-SUB PART SET.
C
C NP                   1  FIXED    NR OF PART TYPES PROCESSED IN RUN. (THIS
C                                   EXCLUDES PART TYPES WITH ESSENTIALITY CODE
C                                   .LE. IESS OR WITH A ZERO FAILURE RATE)
C
C NP1                  1  FIXED    TOTAL NUMBER OF 'PART NUMBERS' IN THE FULL-SUB
C                                   PART SET
C
C NP2                  1  FIXED    TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
C                                   PART SET
```

```
C
C  NW                  1   FIXED   LENGTH(DAYS) OF SCENARIO
C
C  PTDEP(J,K)     300,24   REAL    TOTAL AMOUNT OF INITIAL STOCK FOR PART J
C                                  RECEIVED AT THEATER(EXCLUDING IN-PLACE STOCK)
C                                  BETWEEN DAY 5*K-4 AND DAY 5*K
C
C  QPA(J)            300   REAL    THE 'QUANTITY PER APPLICATION' FOR PART J.
C                                  I.E. THE STANDARD NUMBER OF ITEMS OF PART J
C                                  INSTALLED ON EACH OPERATIONAL ACFT
C
C  RNC(I)            120   REAL    AC AVAILABILITY IMPLIED BY STOCKAGE OF
C                                  (COMPUTED RQMT + CURRENT INVENTORY) OR BY
C                                  STOCKAGE OF ONLY THE CURRENT INVENTORY
C
C  RNCS(J)           300   REAL    THE SUM OF THE COMPUTED RQMT FOR PART J AND
C                                  THE CUM INITIAL STOCK ISSUED/DEPLOYED THRU
C                                   DAY I
C
C  SUMB(I)           120   REAL    TOTAL STOCKOUTS OVER ALL PARTS IN THE NO-SUB
C                                  PART SET,AS CALCULATED  DAY I  DURING
C                                  CAPABILITY ASSESSMENT
C
      COMMON
     +     AC(120),         ACL,             ADESC(300),     ALLOW1(120),
     +     ALLOW2(120),     AMSN(300),       ASURV(120),     AVAVG(6),
     +     AVM(120),        BCY(300),        BF(300),        CASE,
     +     COMDA(300),      CF(300),         CL,             CMINT,
     +     CNCS(300),       COST1(300),      CRNCS(300),     DCOST1(300),
     +     DCOSTF(120),     DCY(300),        DF(300),        DMD(300),
     +     DOD(300),        FHA(120),        FHM,            FHPAPD(3,120),
     +     FHR(120),        ICOST,           IDCC(2),        IFHC(120),
     +     IFS(300),        IMSEL,           INS(300),       INT,
     +     IPT(120),        IRC(300),        IPO(300),       ISHORT,
     +     NP,              NP1,             NP2,            NW,
     +     PTDEP(300,24),   CPA(300),        RNC(120),       RNCS(300),
     +     SM(120,100),     SRMAX1(300),     STK(300),       SUMB(120),
     +     TRNCS(300),      TSTK(300),       TSUMB
      DIMENSION
     +     DMOT(300),       FHN1(120),       FHN2(120)
      CHARACTER*16
     +     ADESC,           ADSC,            AMSN,           CASE
      BMAX=0.
      AVAVG(1)=0.
      AVAVG(3)=0.
      TFHNC=0.
      TSURV=0.
      INCD=0.
      DO 100 I=1,NW
        TSURV=TSURV+ASURV(I)
        SUMB(I)=0.
        DO 100 K=1,3
  100 FHPAPD(K,I)=0.
      DO 200 J=1,NP
        DOD(J)=0.
        DMOT(J)=0.
  200 DMD(J)=0.
      XX=ASURV(1)
      TAV=0.
C
C  THRU STMT 1200 PROCESS EACH DAY
C
      DO 1200 I=1,NW
        IA=(I-1)/5+1
C
C  SET RNCS=REQMT +ISSUED INITIAL STOCK THRU DAY I
C
        DO 300 J=1,NP
  300   RNCS(J)=RNCS(J)+(IND-1)*PTDEP(J,IA)/5.
C
C  CALCULATE INITIAL ESTIMATED ACFT AVAILABLE THIS DAY AS THOSE AVAILABLE
C  YESTERDAY+NEWLY DEPLOYED ACFT. THEN CALCULATE ESTIMATED FLYING HOURS
C  ACHIEVED BASED ON THE ESTIMATED ACFT AVAILABLE.
C
        IF (I.GT.1) XX=RNC(I-1)*ASURV(I-1)+AC(I)-AC(I-1)
        FHA(I)=AMIN1(XX*FHM,FHR(I))
        IND=0
        IF (NP2.EQ.0) GO TO 500
C
C  THRU STMT 500 DO NMCS ACFT ASSESSMENT FOR THE NO-SUB SET.
C  ZP=NET DEMAND (BACKORDERS)FROM PART K SUMB(I)= TOTAL NO-SUB BACKORDERS
C  =TOTAL NMCS ACFT FROM ALL NO-SUB PARTS ON DAY I.
```

```
C
  400   DO 500 K=1,NP2
          II=INS(K)
          XX=DMDT(II)
          DMDT(II)=SR(I,II,XX)
          ZP=DMDT(II)-RNCS(II)
  500   SUMB(I)=SUMB(I)+AMAX1(0.,ZP)
  600   IF (NP1.EQ.0) GO TO 800
C
C THRU STMT 700 DO NMCS ACFT ASSESSMENT FOR THE FULL-SUB SET.
C BOFCS=NET DEMAND (BACKORDERS)FROM PART K/QPA = NMCS ACFT FROM THIS
C FULL-SUB PART. BMAX = TOTAL NMCS ACFT FROM ALL FULL-SUB PARTS PROCESSED
C
        BMAX=0.
        DO 700 K=1,NP1
          II=IFS(K)
          XX=DMDT(II)
          DMDT(II)=SR(I,II,XX)
          BOFCS=(DMDT(II)-RNCS(II))/QPA(II)
          IF (BOFCS.LE.0.) BOFCS=0.
          BMAX=AMAX1(BMAX,BOFCS)
  700   CONTINUE
C
C CALCULATE AUNCS=TOTAL AVAILABLE(NON-NMCS) ACFT FROM ALL PARTS. THEN
C CONVERT IT TO A FRACTION AVAILABLE.
C
  800   AUNCS=AMAX1(0.,ASURV(I)-SUMB(I)-BMAX)
        FHNC(I)=AMIN1(FHR(I),AUNCS*FHM)
        FHPAPO(3,I)=AMIN1(FHM,FHR(I)/(AUNCS+.01))
        FHNZ(I)=FHNC(I)/(FHR(I)+.000001)
        AUNCS=AUNCS/(ASURV(I)+.00001)
C
C CHECK WHETHER ITERATIONS SHOULD STOP. COMPUTE Z=DIFFERENCE BETWEEN
C INITIAL EST FLYING HRS AND CALULCULATED FLYING HRS ACHIEVED CHECK
C IF Z/(AVG DAILY PGM FLYING HRS) .LT. CONVF(INPUT).  IF SO,
C CONVERGENCE IS CLOSE ENOUGH TO TERMINATE ITERATIONS . ALSO CHECK
C IF ITERATIONS IS .GE. LIMIT(INPUT). IF SO,STOP ITERATIONS.
C
        Z=ABS(FHNC(I)-FHA(I))
        INDX=INDX+1
        IF (INDX.GE.LIMIT.OR.(Z/(TTFH+1.)).LE.(CONVF/NW).OR.INDX.GT.30)
     +  GO TO 1000
C
C CALC NEW EST FLYING HRS ACHIEVED(USED IN SUBROUTINE SR TO CALC NET DEMAND
C
        FHA(I)=.5*(FHA(I)+FHNC(I))
        BMAX=0.
        SUMB(I)=0.
C
C RESET CUM DEMAND THRU LAST DAY WHEN A NEW ITERATION IS TO RESUME
C
        DO 900 J=1,NP
  900   DMDT(J)=DMD(J)
        GO TO 400
 1000   TFHNC=TFHNC+FHNC(I)
        DO 1100 J=1,NP
 1100   DMD(J)=DMDT(J)
C
C CALC THE AVG DAILY DISCREPANCY(Z) BETWEEN THE STARTING AND ENDING DAILY
C FLYING HR ESTIMATES,EXPRESSED AS A % OF AVG DAILY FLYING PGM. ACCUMULATE
C THE AVG FRACTION OF THE FLYING PGM THAT IS ACHIEVED(FNC). CALC AVG
C ACFT AVAILABILITY(AX) REQUIRED TO ACHIEVE THE DAY'S FLYING HR AND AVAIL
C OBJECTIVES
C
        TNCD=TNCD+Z
        RNC(I)=AUNCS
        TAV=TAV+RNC(I)*ASURV(I)
 1200 CONTINUE
      Z=100.*TNCD/(TFHNC+.001)
      FNC=TFHNC/TTFH
      IF (IP.EQ.0) RETURN
C
C PRINT THE CAPABILITY ASSESSMENT RESULTS ON A DAILY BASIS,W/AVERAGES
C
      DO 1400 I=1,NW
        SUMB(I)=SUMB(I)/(ASURV(I)+.00001)
        AX=1.-(ALLOWB(I)/(ASURV(I)+.0000001))
        IF (MOD(I-1,50).NE.0) GO TO 1300
        WRITE (6,1500) CASE
        IF (ICOST.EQ.1.AND.IND.EQ.1) WRITE (6,1600)
        IF (ICOST.EQ.1.AND.IND.EQ.2) WRITE (6,1700)
        IF (ICOST.EQ.0) WRITE (6,1800) KNTC
```

```
            IF (ICOST.EQ.1) WRITE (6,1903) CL
            WRITE (6,2000)
C
C CALC AVG ACFT AVAILABILITY(AVAVG(1)),WEIGHTED BY DAILY NR OF ACFT SURVIVING.
C CALC AVG ACHIEVED PGM FLYING HRS/ACFT/DAY(AVAVG(3)),WEIGHTED BY DAILY NR
C OF ACFT AVAILABLE.
C
            WRITE (6,2100) Z
            WRITE (6,2000)
            WRITE (6,2200)
            WRITE (6,2300)
            WRITE (6,2400)
            WRITE (6,2000)
 1300       AVAVG(1)=AVAVG(1)+RNC(I)*ASURV(I)/TSURV
            AVAVG(3)=AVAVG(3)+FHPAPD(3,I)*RNC(I)*ASURV(I)/TAV
 1400 WRITE (6,2500) I,RNC(I),AX,I,FHNZ(I),FHPAPD(3,I)
      WRITE (6,2600) AVAVG(1),AVAVG(2),FNC,AVAVG(3)
      RETURN
 1500 FORMAT (1H1,30X,'CASE= ',A16)
 1600 FORMAT (/,1X,'** FORCE  CAPABILITY WITH CONSTR COST TOTAL  ','RQMT
     + SOLUTION STJCKED AT RETAIL',//,' *  (NO POST D-DAY PARTS DEPLOYED
     +) *')
 1700 FORMAT (/,1X,'** FORCE  CAPABILITY WITH CONSTR COST RESIDUAL  ','R
     +QMT SOLUTION STOCKED & DEPLOYED **')
 1800 FORMAT  (/,1X,'** FORCE  CAPABILITY GIVEN  THE CURRENT',' INV','EN
     +TORY STKED & DEPLOYED FOR  POLICY',I3,' **')
 1900 FORMAT (///,10X,'COST LIMIT OF',F12.0)
 2000 FORMAT (/)
 2100 FORMAT (' TOTAL  FLY HRS CONVERGED TO',' WITHIN',F7.3,' PERCENT')
 2200 FORMAT (9X,'  ACHIEVED',22X,'ACHIEVED')
 2300 FORMAT (11X,'     ACFT',22X,'FRACTION',4X,'FLY HRS/AC')
 2400 FORMAT(6X,'DAY',5X,'AVAIL',3X,'REQ AVAIL',6X,'DAY',3X,'FH PGM'11X,
     +'/DAY')
 2500 FORMAT (5X,I4,5X,F5.3,7X,F5.3,5X,I4,4X,F5.3,6X,F8.1)
 2600 FORMAT (/,' AVERAGES ',4X,F5.3,7X,F5.3,13X,F5.3,10X,F5.1)
      END
```

(NOT USED)

# SUBROUTINE CCLIST

```
      SUBROUTINE CCLIST (IG,IORD,IND)
C NAME: CCLIST           TYPE: SUBROUTINE
C
C PURPOSE: THE CCLIST (CONSTRAINED COST REQUIREMENTS LIST) SUBROUTINE
C PRINTS THE CONSTRAINED COST REQWUIREMENTS SOLUTION.
C
C CALLED BY: MAIN PROGRAM
C
C CALLS
C       -SUBROUTINE MAXC: ORDERS THE LIST OF RQUIREMENTS TO BE PRINTED
C
C               OUTPUT - UNIT 6 (PRINT)
C
C
C FILES USED :OUTPUT - UNIT 6(PRINT)
C             INPUT  - NONE
C
C LOCAL ARRAYS : NONE
C
C
C ARGUMENTS
C
C
C NAME                  TYPE            DESCRIPTION
C
C
C
C IG                    FIXED    INDICATOR TO SUBROUTINE CCLIST OF WHETHER CONSTR
C                                COST ALGORITHM 1(IG=1) OR CONSTR COST ALGORITHM
C                                2 (IG=2)WAS USED TO DETERMINE THE FINAL CONST
C                                COST SOLUTION
C
C
C IND                   FIXED    INDICATOR OF WHETHER TOTAL(INIT STK=0) OR
C                                RESIDUAL(INIT STK='CURRENT INVENTORY') REQMTS
C                                ARE BEING PROCESSED .IND=1 INDICATES TOTAL
C                                REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
C
C
C IORD                  FIXED    RUN OPTION(INPUT). IF IORD .LE. 0,THEN THE
C                                SOLUTION REQMTS LISTS WILL BE ORDERED ACCORDING
C                                TO DECREASING UNIT COST OF PART.IF OPT3 .GT. 0
C                                THE REQMTS LISTS ARE ORDERED BY (DECREASING)
C                                AMOUNT OF SOLUTION REQMT.
C
C
C
C
C COMMON BLOCK (UNLABELED) ENTRIES
C
C
C NAME      DIMENSION   TYPE            DESCRIPTION
C
C
C
C ACL               1   REAL     THE AMOUNT(S) OF SUSTAINABILITY DOLLARS,
C                                BASED ON THE 'CUM REQMT COST THRU DAY N'
C                                TABLES,WHICH IS THE CLOSEST APPROXIMATION
C                                TO THE INPUT  COST LIMIT FOR THE CONSTRAINED
C                                COST CASE
C
C
C ADESC(J)        300   CHAR     16 CHAR DESCRIPTION OF SPARE PART J
C
C
C ANSN(J)         300   CHAR     IDENTIFICATION NR(NSN) OF SPARE PART J
C
C
C CASE                  CHAR     CASE ID
C
C
C CL                1   REAL     THE COST LIMIT (AS SPECIFIED  BY INPUT) USED
C                                IN THE CONSTRAINED COST REQMTS CASE.
C
C
C CNCS(J)         300   REAL     TOTAL COST  OF REQMT FOR PART J USING
C                                THE SPECIFIED PART  REPLACEMENT POLICY.
C
C COST(J)         300   REAL     COST OF A SINGLE ITEM OF PART J . THIS IS
C                                ALSO DENOTED AS 'PART UNIT COST'.
C
```

```
C
C DOD(J)            300  REAL     ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
C                                  IN SUBROUTINE MAXC. IN SUBROUTINE CLIST
C                                  THIS HAS THE AMOUNT OF THE SOLUTION REQMT
C                                  FOR PART J.
C
C IDCC(IND)           2  FIXED    STORES ,FOR EITHER TOTAL(IND=1) OR RESIDUAL
C                                  (IND=2), THE LATEST DAY FROM THE ' CUM COST
C                                  REQMT THRU DAY N' TABLE (FROM THE UNCONSTR
C                                  COST CASE) FOR WHICH ASSOCIATED CUM COST
C                                  IS LESS THAN OR = THE INPUT-SPECIFIED COST
C                                  LIMIT USED IN THE CONSTRAINED COST CASE.
C
C IRC(J)            300  FIXED    ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
C                                  DECREASING PART UNIT COST FOR ASSOCIATED PART
C
C IRO(J)            300  FIXED    ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
C                                  DECREASING SOLUTION REQMT AMOUNT FOR ASSOCIATED
C                                  PART
C
C NP                  1  FIXED    NR OF PART TYPES PROCESSED IN RUN. (THIS
C                                  EXCLUDES PART TYPES WITH ESSENTIALITY CODE
C                                  .LE. IESS OR WITH A ZERO FAILURE RATE)
C
C RNCS(J)           300  REAL     THE CALCULATED REQMT FOR PART J
C
C
C
      COMMON
     +     AC(120),          ACL,             ADESC(300),      ALLOW1(120),
     +     ALLOW2(120),      AMSN(300),       ASURV(120),      AVAVG(6),
     +     AVM(120),         BCY(300),        BF(300),         CASE,
     +     CDMDA(300),       CF(300),         CL,              CMINT,
     +     CNCS(300),        COST(300),       CPNCS(300),      DCOST1(300),
     +     DCOSTF(120),      DCY(300),        DF(300),         DMD(300),
     +     DOD(300),         FHA(120),        FHM,             FHPAPD(3,120),
     +     FHR(120),         ICOST,           IDCC(2),         IFHC(120),
     +     IFS(300),         IMSEL,           INS(300),        INT,
     +     IPT(120),         IRC(300),        IRO(300),        ISHORT,
     +     NP,               NP1,             NP2,             NW,
     +     PTDEP(300,29),    QPA(300),        RNC(120),        RNCS(300),
     +     SM(120,100),      SRMAX1(300),     STK(300),        SUMB(120),
     +     TRNCS(300),       TSTM(300),       TSUMB
      CHARACTER*16
     +     ADESC,            ADSC,            AMSN,            CASE
      IF (IORD.LE.0) GO TO 300
C
C IF IORD .GT. ORDER THE REQMTS LIST BY DECREASING AMOUNT OF REQMT
C
      DO 100 I=1,NP
         IRO(I)=0
  100 DOD(I)=RNCS(I)
      NDUMMY=NP
      DO 200 K=1,NP
         CALL MAXC (NDUMMY,NOUT)
         IRO(K)=NOUT
         II=IRO(K)
  200 DOD(II)=-1.
C
C PRINT THE CONSTRAINED COST REQMTS SOLUTION
C
  300 DO 500 I=1,NP
         II=IRO(I)
         IF (IORD.LE.0) II=IRC(I)
         IF (MOD(I-1,50).NE.0) GO TO 400
         WRITE (6,600) CASE
         IF (IND.EQ.1) WRITE (6,700)
         IF (IND.EQ.2) WRITE (6,800)
         WRITE (6,900)
         IF (IG.EQ.1) WRITE (6,1000) CL,ACL
         IF (IG.EQ.2) WRITE (6,1100) CL,ACL,IDCC(IND)
         WRITE (6,900)
         WRITE (6,1200)
         WRITE (6,900)
  400    CNCS(II)=COST(II)*RNCS(II)
         TC=100.*CNCS(II)/(ACL+.000001)
  500 WRITE (6,1400) I,II,AMSN(II),ADESC(II),RNCS(II),CNCS(II),TC
      RETURN
  600 FORMAT (1H1,30X,'CASE= ',A16)
```

```
  700 FORMAT (/,23X,' TOTAL(INIT STK=0)  STK RQMTS ')
  800 FORMAT (/,30X,'RESIDUAL(INIT STK=CURR STK) STK RQMTS ')
  900 FORMAT (/)
 1000 FORMAT (//,10X,'COST LIMIT OF',F12.0,' APPROXIMATED BY',F12.0,//,
     +10X,'USING A COMBINED (CHEAPEST NO SUB PARTS)/SUSTNBLTY SOL ')
 1100 FORMAT (//,10X,'COST LIMIT OF',F12.0,' APPROXIMATED BY',F12.0,//,
     +10X,'USING A SUSTAINIBILITY SOLUTION FOR COST THRU',I4,' DAYS')
 1300 FORMAT (10X,'PART NR',17X,'PART',21X,'RQMNT',7X,'COST  %COST')
 1400 FORMAT (2X,I5,I10,5X,A16,2X,A16,F8.1,F12.0,F6.2,4X)
      END
```

(NOT USED)

# SUBROUTINE DIST

```
      SUBROUTINE DIST (IFDAY,ILDAY,DAMT,K)
C NAME: DIST                TYPE: SUBROUTINE
C
C PURPOSE: THE DIST  (PARTS DISTRIBUTION) SUBROUTINE DISTRIBUTES THE
C STARTING SPARES STOCK OF A PART TYPE OVER A SERIES OF 5-DAY INTERVALS
C
C CALLED BY: MAIN PROGRAM
C
C CALLS : NONE
C
C FILES USED : NO FILES READ OR WRITTEN
C
C
C
C ARGUMENTS
C
C
C NAME                     TYPE            DESCRIPTION
C
C
C
C IFDAY                    FIXED    FIRST DAY OF PERIOD OVER WHICH THE STOCK IS
C                                   DISTRIBUTED(THE DISTRIBUTION PERIOD)
C
C ILDAY                    FIXED    LAST DAY OF PERIOD OVER WHICH THE STOCK IS DISTRIBUTED
C
C DAMT                     REAL     AVERAGE AMOUNT OF STOCK DISRIBUTED EACH DAY DURING
C                                   THE DISTRIBUTION PERIOD
C
C K                        FIXED    PART NUMBER OF THE PART BEING DISTRIBUTED
C
C
C LOCAL ARRAYS : NONE
C
C
C
C
C
C COMMON BLOCK (UNLABELED) ENTRIES
C
C
C NAME       DIMENSION  TYPE             DESCRIPTION
C
C
C PTDEP(J,K)   300,24   REAL      TOTAL AMOUNT OF INITIAL STOCK FOR PART J
C                                 RECEIVED AT THEATER(EXCLUDING IN-PLACE STOCK)
C                                 BETWEEN DAY 5*K-4 AND DAY 5*K
C
      COMMON
     *    AC(120),        ACL,            ADESC(300),     ALLOWI(120),
     *    ALLOWB(120),    AMSN(300),      ASURV(120),     AVAV6(6),
     *    AVM(120),       BCY(300),       BF(300),        CASE,
     *    CDMDA(300),     CF(300),        CL,             CMINT,
     *    CNCS(300),      COST(300),      CRNCS(300),     DCOSTI(300),
     *    DCOSTF(120),    DCY(300),       DF(300),        DMD(300),
     *    DOD(300),       FHA(120),       FHM,            FHPAPD(3,120),
     *    FHR(120),       ICOST,          IDCC(2),        IFHC(120),
     *    IFS(300),       INSEL,          INS(300),       INT,
     *    IPT(100),       IRC(300),       IRO(300),       ISHORT,
     *    NP,             NP1,            NP2,            NW,
     *    PTDEP(300,24),  OPA(300),       RNC(120),       RNCS(300),
     *    SM(120,100),    SRMAX1(300),    STK(300),       SUMB(120),
     *    TRNCS(300),     TSTK(300),      TSUMB
      CHARACTER*16
     *    ADESC,          ADSC,           AMSN,           CASE
C
C CALCULATE :
C    D1= 5-(NR OF DAYS OF DISTRIBUTION IN FIRST 5-DAY INTERVAL OF DISTRIBUTION PERIOD)
C    DL=NR OF DAYS OF DISTRIBUTION IN LAST 5-DAY INTEPVAL OF DISTRIBUTION PERIOD
C    I1=ORDINAL NR(IN FULLWAR)OF FIRST 5-DAY INTERVAL IN DISTRIBUTION PERIOD
C    IL=ORDINAL NR(IN FULLWAR)OF LAST 5-DAY INTERVAL IN DISTRIBUTION PERIOD
C
      D1=-((IFDAY-1)/5)*5+IFDAY-1
      DL=-((ILDAY-1)/5)*5+ILDAY
      I1=MIN0(24,(IFDAY-1)/5+1)
      IL=MIN0(24,(ILDAY-1)/5+1)
      IF (I1.LT.IL) GO TO 100
      PTDFP(K,I1)=PTDEP(K,I1)+(DL-D1)*DAMT
      RETURN
  100 DO 200 I=I1,IL
        IF (I.EQ.I1) PTDEP(K,I)=PTDEP(K,I)+(5.-D1)*DAMT
```

```
            IF (I.EQ.IL) PTDEP(K,I)=PTDEP(K,I)+DL*DAMT
            IF (I.GT.I1.AND.I.LT.IL) PTDEP(K,I)=PTDEP(K,I)+5.*DAMT
    200 CONTINUE
        RETURN
        END
```

## SUBROUTINE MAXC

```
      SUBROUTINE MAXC (NDUMMY,NOUT)
C NAME: MAXC               TYPE: SUBROUTINE
C
C PURPOSE: THE MAXC SUBROUTINE FINDS THE SUBSCRIPT OF THE LARGEST(IN VALUE
C          MEMBER OF AN ARRAY (DOD(J))
C
C
C CALLED BY:
C          - MAIN PROGRAM
C          - SUBROUTINE UCROPS
C          - SUBROUTINE CCLIST
C
C CALLS : NONE
C
C FILES USED : NO FILES READ OR WRITTEN
C
C
C
C ARGUMENTS
C
C
C NAME                   TYPE             DESCRIPTION
C
C
C
C NDUMMY                 FIXED    THE NR OF ITEMS IN THE ARRAY BEING PROCESSED
C
C NOUT                   FIXED    THE SUBSCRIPT ASSOCIATED WITH THE LARGEST VALUE
C                                 IN ARRAY DOD(J) AT EACH CALL OF THIS SUBROUTINE
C
C
C LOCAL ARRAYS : NONE
C
C
C
C
C
C COMMON BLOCK (UNLABELED) ENTRIES
C
C NAME      DIMENSION  TYPE               DESCRIPTION
C
C
C DOD(J)          300  REAL      ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
C                                IN SUBROUTINE MAXC. IN MAIN PGM,THIS HAS PART
C                                UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
C                                UCROPS,THIS HAS THE AMOUNT OF THE SOLUTION
C                                REQMT FOR PART J.
C
      COMMON
     +     AC(120),           ACL,             ADESC(300),      ALLOW1(120),
     +     ALLOWB(120),       AMSN(300),       ASURV(120),      AVAVG(6),
     +     AVM(120),          BCY(300),        BF(300),         CASE,
     +     CDMOA(300),        CF(300),         CL,              CMINT,
     +     CNCS(300),         COST(300),       CRNCS(300),      DCOST1(300),
     +     DCOSTF(120),       DCY(300),        DF(300),         DMD(300),
     +     DOD(300),          FHA(120),        FHM,             FHPAPO(3,120),
     +     FHR(120),          ICOST,           IDCC(2),         IFHC(120),
     +     IFS(300),          INSEL,           INS(300),        INT,
     +     IPT(100),          IRC(300),        IPO(300),        ISHORT,
     +     NP,                NP1,             NP2,             NW,
     +     PTDEP(300,24),     OPA(300),        RNC(120),        RNCS(300),
     +     SM(120,100),       SRMAX1(300),     STK(300),        SUMB(120),
     +     TRNCS(300),        TSTK(300),       TSUMB
      CHARACTER*16
     +     ADESC,             ADSC,            AMSN,            CASE
      SMAX=-1.
      JMAX=1
      DO 100 J=1,NDUMMY
        X=DOD(J)
        ZMAX=AMAX1(SMAX,X)
        IF (ZMAX.LE.SMAX) GO TO 100
        JMAX=J
        SMAX=ZMAX
  100 CONTINUE
      NOUT=JMAX
      RETURN
      END
```

(NOT USED)

# SUBROUTINE NCRNCT

```
      SUBROUTINE NCRNC (ND,I2,IND)
C NAME: NCRNC          TYPE: SUBROUTINE
C
C PURPOSE: THE NCRNC  (NO CANNIBALIZATION REQUIREMENTS) SUBROUTINE
C GENERATES  A LEAST COST RQMNTS MIX OF SPARE PARTS NEEDED TO ACHIEVE A
C FLEET  FLYING HR PROGRAM/AVAILABILITY OBLECTIVE USING A USER-SPECIFIED
C PARTS  REPLACEMENT POLICY AND UNCONSTRAINED  COSTS.
C
C CALLED BY: SUBROUTINE UCROPS
C
C CALLS
C      -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
C                    FOR A SPECIFIED PART
C
C FILES USED : NO FILES READ OR WRITTEN
C
C
C
C ARGUMENTS
C
C
C NAME                  TYPE            DESCRIPTION
C
C ND                    FIXED   CURRENT DAY BEING PROCESSED
C
C I2                    FIXED   NR OF ALLOWABLE NMCS ACFT ASSOCIATED WITH THE
C                               NO-SUB PART SET AT THIS STAGE OF THE REQMT ALGORITHM
C
C IND                   FIXED   INDICATOR OF WHETHER TOTAL(INIT STK=0) OR
C                               RESIDUAL(INIT STK='CURRENT INVENTORY') REQMTS
C                               ARE BEING PROCESSED .IND=1 INDICATES TOTAL
C                               REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
C
C
C
C
C
C LOCAL ARRAYS
C
C
C NAME      DIMENSION  TYPE              DESCRIPTION
C
C
C SUMBZ(I)        120  REAL     CUMULATIVE RAW(INIT STK=0) DEMANDS
C                          (ALL PARTS) THRU DAY I
C
C SUMP(I)         120  REAL     TOTAL UNITS(ALL PARTS) STOCKED IN EXCESS
C                            OF EXPECTED DEMAND ON DAY I)
C
C
C
C COMMON BLOCK (UNLABELED) ENTRIES
C
C
C NAME      DIMENSION  TYPE              DESCRIPTION
C
C
C ALLOW1(I)       120  REAL    THE 'ALLOWABLE NMCS ACFT' FOR THE NO-SUB
C                              SET ON DAY I,COMPUTED AFTER DAY I IS PROCESSED.
C                              AFTER IT IS CALCULATED FOR DAY I, IT IS FIXED
C                              DURING ITERATIVE CALCULATIONS (INVOLVING DAYI)
C                              FOR NO-SUB REQMTS ON LATER DAYS.
C
C ALLOWB(I)       120  REAL    MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
C                              WILL STILL ALLOW ACHIEVMENT OF CASE OBJECTIVE
C                              (FLYING HOUR AND AVAILABILITY) ON DAY I
C
C CDMDA(J)        300  REAL    ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
C                              (BASED ON INITIAL STK=0) FOR PART J ON THE
C                              SCENARIO DAY BEING PROCESSED
C
C CRNCS(J)        300  REAL    THE UNCONSTRAINED COST SOLUTION REQMT FOR
C                              PART J AT ANY STAGE OF THE PARTIAL SUB
C                              REQUIREMENT CALCULATION ALGORITHM.
C
C INS(J)          300  FIXED   ARRAY STORING THE PARCOM PART NUMBERS OF THE
C                              PARTS IN THE NO-SUB PART SET.
C
C INT               1  FIXED   THE INTERVAL AT WHICH THE PARTIAL SUB
C                              COMPUTATION ALGORITHM (ROUTINE UCROPS)
C                              INCREMENTS VALUES FOR 'ALLOWABLE NMCS ACFT'
```

```
C                                            AT EACH STAGE OF CALCULATION OF SEPARATE REQMT
C                                            SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB
C                                            SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS
C                                            VALUE IS SET =1 IN THE PROGRASM CODE.
C
C NP2                 1  FIXED               TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
C                                            PART SET
C
C RNCS(J)           300  REAL                TOTAL REQMT(INIT STK=0) FOR PART J USING A
C                                            'NO SUBSTITUTION' REPLACEMENT POLICY
C                                             WITH UNCONSTRAINED COST
C
C TSUMB               1  REAL                THE TOTAL NET STOCKOUT FROM ALL NO-SUB PARTS
C                                            PROCESSED AT ANY STAGE OF THE NO-SUB REQMTS
C                                            CALCULATION PORTION OF THE PARTIAL SUB REQMT
C                                            ALGORITHM
C
C
      COMMON
     +    AC(120),        ACL,            ADESC(300),     ALLOW1(120),
     +    ALLOWB(120),    AMSN(300),      ASURV(120),     AVAVG(6),
     +    AVM(120),       BCY(300),       BF(300),        CASE,
     +    CDMDA(300),     CF(300),        CL,             CMINT,
     +    CNCS(300),      COST(300),      CRNCS(300),     DCOSTI(300),
     +    DCOSTF(120),    DCY(300),       DF(300),        DMD(300),
     +    DDD(300),       FHA(120),       FHM,            FHPAPD(3,120),
     +    FHR(120),       ICOST,          IDCC(2),        IFHC(120),
     +    IFS(300),       IMSEL,          INS(300),       INT,
     +    IPT(100),       IRC(300),       IRO(300),       ISHORT,
     +    NP,             NP1,            NP2,            NW,
     +    PTDFP(300,24),  QPA(300),       RNC(120),       RNCS(300),
     +    SM(120,100),    SRMAX1(300),    STK(300),       SUMB(120),
     +    TRNCS(300),     TSTK(300),      TSUMB
      DIMENSION
     +    SUMBZ(120),     SUMP(120)
      CHARACTER*16
     +    ADESC,          ADSC,           AMSN,           CASE
      NA=ALLOWB(ND)*.5
      IF (I2.LT.NA) GO TO 200
      SUMP=0.
      TSUMB=0.
      DO 100 L=1,ND
         SUMP(L)=0.
  100 SUMBZ(L)=0.
  200 TOTZ=0.
C
C ALL PARTS ARE PROCESSED FOR THIS DAY(ND) IN THE FOLLOWING LOOP
C
      DO 700 K=1,NP2
         II=INS(K)
C
C MAKE A DIRECT CALCULATION OF NET DEMAND(BASED ON INIT STK=0) ONLY
C FOR THE COMBINAITION (I1,I2) IN WHICH ALLOWED NMCS ACFT FOR THE NO-SUB
C PARTS(I2)=ALLOWED NMCS ACFT FOR ALL PARTS(ALLOWB(ND)) OTHERWISE DO
C A SHORT-CUT CALCULATION
C
         IF (I2.LT.NA) GO TO 400
         CDMDA(II)=0.
C
C ASSUME THAT THE (PREVIOUSLY COMPUTED) MIN REQMT(RNCS) PLUS ISSUED
C STOCK AS OF THIS DAY(TSTK) ARE 'BOUGHT',I.E. THESE ARE 'SUNK' COSTS.
C
         CRNCS(II)=RNCS(II)
         IF (IND.EQ.2) CRNCS(II)=TSTK(II)+RNCS(II)
C
C FOR EACH PART ,RECURSIVELY COMPUTE THE EFFECTS OF REQMT 'BUYS' THRU
C ALL DAYS UP TO CURRENT DAY IN THE FOLLLOWING LOOP.
C
C
C  CALC CUMULATIVE NET DEMAND (CDMD) FOR PART II THRU DAY I.
C  THEN CALC (SUMBZ(I)) TOTAL NET DEMAND THRU DAY I OVER THE K MOST
C  EXPENSIVE PART TYPES. FINALLY CALC (TSUMB) THE NET TOTAL STOCKOUT
C  ('HOLES') THRU DAY I AND SET THE RQMNT FOR PART II= THE DIFFERENCE
C  BETWEEN THE NET TOTAL STOCKOUT AND THE ALLOWABLE STOCKOUT(ALLOWB(I)).
C  THIS CALC IMPLICITLY ASSUMES (THRU SUMR) THAT THE RQMNTS FOR THE
C  (K-1) MOST EXPENSIVE PARTS HAVE BEEN COMPUTED AND BOUGHT.
C
         DO 300 I=1,ND
            CDMD=CDMDA(II)
            CDMDA(II)=SR(I,II,CDMD)
            IF (IND.EQ.2) SUMP(I)=SUMP(I)+AMAX1(0.,(CRNCS(II)-CDMDA(II)))
            SUMBZ(I)=SUMBZ(I)+CDMDA(II)
```

```
                TSUMB=AMAX1(SUMBZ(I)-SUMR+SUMP(I),0.)
                IF ((TSUMB-CRNCS(II)).GE.ALLOW1(I)) CRNCS(II)=TSUMB-ALLOW1(I)
  300     CONTINUE
C
C  CALC (SUMR) TOTAL UNITS STOCK REQUIRED FOR THE K MOST EXPENSIVE
C  PARTS
C
          SUMR=SUMR+CRNCS(II)
          GO TO 700
C
C THE FOLLOWING IS THE SHORT-CUT CALCULATION OF REQMTS FOR THE NO-SUB
C CASE. GIVEN THE THE BASE REQMT,I.E. THE DIRECTLY  COMPUTED NO-SUB
C REQMT FOR THE CASE WITH ALLOWED NMCS ACFT FOR THE NO-SUB SET(I2)=NA,
C THEN,IF N FEWER NMCS ACFT ARE ALLOWED (FOR THE NO-SUB SET),THE
C COST EFFECTIVE APPROACH IS TO BUY N MORE OF THE CHEAPEST PARTS WHOSE
C REQMTS IN THE BASE(I2=NA) SOLUTION(+INIT STK) ARE .LT. THEIR NET DEMAND.
C FRACTIONAL REQMTS IN THE BASE SOLUTION  COMPLICATED THE PROGRAMMING.
C
  400     ZINT=MIN0(INT,NA-I2)
          IF (I2.GE.(TSUMB+.5)) RETURN
          IL=INS(NP2-K+1)
          IF ((CRNCS(IL)+(IND-1)*ZINT*TSTK(IL)).GE.CDMDA(IL)) GO TO 700
          Z=CRNCS(IL)+ZINT
          TZ=Z+(IND-1)*ZINT*TSTK(IL)-CDMDA(IL)
          IF (TZ.LE.0) GO TO 500
          CRNCS(IL)=CDMDA(IL)-(IND-1)*ZINT*TSTK(IL)
          TOTZ=TOTZ+ZINT-TZ
          IF (TOTZ.LT.ZINT) GO TO 700
          CRNCS(IL)=CRNCS(IL)-TOTZ+ZINT
          GO TO 600
  500     CRNCS(IL)=CRNCS(IL)+AMIN1(ZINT-TOTZ,ZINT)
  600     TSUMB=TSUMB-ZINT
          RETURN
  700 CONTINUE
      IF (I2.EQ.NA) TSUMB=TSUMB-CRNCS(II)
      IF (I2.LT.NA.OR.IND.EQ.1) RETURN
C
C FOLLOWING CONVERTS REQMT TO AN ADD-ON(RESIDUAL) REQMT BY SUBTRACTING
C OUT INITIAL STOCK(TSTK)ISSUED THRU THIS DAY(ND)
C
      DO 800 K=1,NP2
        J=INS(K)
  800 CRNCS(J)=CRNCS(J)-TSTK(J)
      RETURN
      END
```

(NOT USED)

# SUBROUTINE UCCAP

```
      SUBROUTINE UCCAP (IND)
C NAME: UCCAP             TYPE: SUBROUTINE
C
C PURPOSE: THE UCCAP (UNCONSTRAINED COST CAPABILITY ASSESSMENT) SUBROUTINE
C COMPUTES FLEET CAPABILITY (AVG AVAILABILITY,PGM FLYING HRS/ACFT/DAY) BASED
C ON THE UNCONSTRAINED COST SOLUTION RQMNT BEING STOCKED IN THE WAR RESERVE
C
C CALLED BY: MAIN PROGRAM
C
C CALLS
C     -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
C                  FOR A SPECIFIED PART
C
C FILES USED : INPUT - NONE
C              OUTPUT - UNIT 6(PRINT)
C
C
C ARGUMENTS
C
C
C NAME                  TYPE            DESCRIPTION
C
C
C IND                   FIXED     INDICATOR OF WHETHER TOTAL(INIT STK=0) OR
C                                 RESIDUAL(INIT STK='CURRENT INVENTORY') REQMTS
C                                 ARE BEING PROCESSED .IND=1 INDICATES TOTAL
C                                 REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
C
C
C LOCAL ARRAYS : NONE
C
C
C COMMON BLOCK (UNLABELED) ENTRIES
C
C
C NAME       DIMENSION  TYPE              DESCRIPTION
C
C
C ALLOWB(I)        120  REAL      MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
C                                 WILL STILL ALLOW ACHIEVMENT OF CASE OBJECTIVE
C                                 (FLYING HOUR AND AVAILABILITY) ON DAY I
C
C ASURV(I)         120  REAL      NR AC SURVIVING (NOT ATTRITTED)ON DAY I
C
C AVAVG(K)           6  REAL      AVAVG(1)=AVG ACFT AVAIL ,FROM CAPABILITY
C                                 ASSESSMENT,BASED ON STOCKAGE OF EITHER
C                                 CURR INV OR ( CURR INV + COMPUTED ADD-ON
C                                 REQMTS SOLUTION)
C
C                                 AVAVG(2)=AVG MIN ACFT REQ'D TO ACHIEVE
C                                 THE FLYING HR/AVAILABILITY OBJECTIVE.
C
C                                 AVAVG(3)=AVG FLY HR/AVAIL ACFT / DAY
C                                 ,FROM CAPABILITY ASSESSMENT, BASED ON
C                                 EITHER CURR INV OR (CURR INV + THE SOLUTION
C                                 REQMT) BEING STOCKED.
C
C AVM(I)           120  REAL      AC AVAILABILITY CONSTRAINT (MIN REQUIRED
C                                 NON-NMCS ACFT) FOR DAY I.
C
C CASE                  CHAR      CASE ID
C
C CDMDA(J)         300  REAL      ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
C                                 (BASED ON INITIAL STK=0) FOR PART J ON THE
C                                 SCENARIO DAY BEING PROCESSED
C
C DMD(J)           300  REAL      WORKING VARIABLE USED  IN CALCULATION OF
C                                 NET DEMAND(SR(I,J,..)) FOR PART J ON DAY I
C                                 DURING CAPABILITY ASSESSMENT.
C                                 WHEN (CUM)NET DMD THRU DAY I IS BEING
C                                 CALCULATED,DMD(J) IS (CUM) NET DMD THRU THE
C                                 PREVIOUS DAY.
C
C DOD(J)           300  REAL      ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
C                                 IN SUBROUTINE MAXC. IN MAIN PGM,THIS HAS PART
C                                 UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
C                                 UCRQPS,THIS HAS THE AMOUNT OF THE SOLUTION
C                                 REQMT FOR PART J.
C
C FHM                   REAL      MAXIMUM FLYING HRS PER ACFT PER DAY(INPUT)
C
```

AD-A152 530 EXTENDED PARTS REQUIREMENTS AND COST MODEL (PARCOM) FUNCTIONAL DESCRIPTIO..(U) ARMY CONCEPTS ANALYSIS AGENCY BETHESDA MD W J BAUMAN MAR 85 CAA-D-85-3

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END

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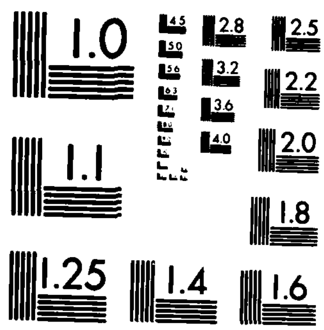
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```
C FHPAPO(K,I)    3,120  REAL     FHPAPO(1,I)=FLYING HRS PER AVAILABLE ACFT PER
C                                FOR DAY I UNDER THE SPECIFIED REPLACEMENT
C                                POLICY BASED ON STOCKING (CURRENT INV +
C                                THE UNCONSTRAINED COST SOLUTION)
C
C
C                                FHPAPO(3,I)=FLYING HRS PER AVAILABLE ACFT PER
C                                FOR DAY I UNDER THE SPECIFIED REPLACEMENT
C                                POLICY STOCKING EITHER CURRENT INVENTORY OR
C                                (CURR INV + THE CONSTRAINED COST SOLUTION)
C
C FHR(I)            120  REAL     FLEET PROGRAM FLYING HOURS REQUIRED ON DAY I
C                                (ACCORDING TO THE INPUT FLYING HR PROGRAM)
C
C IFHC(I)           120  FIXED    INDICATOR TELLING WHICH CONSTRAINT,FLY HR PGM
C                                (IFHC(I)=0) OR ACFT AVAILABILITY(IFHC(I)=1),
C                                DETERMINES REQUIRED DAILY FLEET AVAILABILITY
C                                FOR DAY I
C
C IFS(J)            300  FIXED    ARRAY STORING THE PARCOM PART NUMBERS OF THE
C                                PARTS IN THE FULL-SUB PART SET.
C
C INS(J)            300  FIXED    ARRAY STORING THE PARCOM PART NUMBERS OF THE
C                                PARTS IN THE NO-SUB PART SET.
C
C NP                  1  FIXED    NR OF PART TYPES PROCESSED IN RUN. (THIS
C                                EXCLUDES PART TYPES WITH ESSENTIALITY CODE
C                                .LE. IESS OR WITH A ZERO FAILURE RATE)
C
C NP1                 1  FIXED    TOTAL NUMBER OF 'PART NUMBERS' IN THE FULL-SUB
C                                PART SET
C
C NP2                 1  FIXED    TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
C                                PART SET
C
C NW                  1  FIXED    LENGTH(DAYS) OF SCENARIO
C
C PTOEP(J,K)     300,24  REAL     TOTAL AMOUNT OF INITIAL STOCK FOR PART J
C                                RECEIVED AT THEATER(EXCLUDING IN-PLACE STOCK)
C                                BETWEEN DAY 5*K-4 AND DAY 5*K
C
C QPA(J)            300  REAL     THE 'QUANTITY PER APPLICATION' FOR PART J.
C                                I.E. THE STANDARD NUMBER OF ITEMS OF PART J
C                                INSTALLED ON EACH OPERATIONAL ACFT
C
C RNC(I)            120  REAL     AC AVAILABILITY WHEN TOTAL REQ(INIT STK=0)
C                                IS STOCKED USING A 'NO SUBSTITUTION'
C                                REPLACEMENT POLICY WITH UNCONSTRAINED COST
C
C RNCS(J)           300  REAL     TOTAL REQMT(INIT STK=0) FOR PART J USING A
C                                'NO SUBSTITUTION' REPLACEMENT POLICY
C                                 WITH UNCONSTRAINED COST
C
C STK(J)            300  REAL     INITIAL SERVICEABLE STOCK OF PART J. IT IS THE
C                                SERVICEABLE WAR RESERVE + (IN-PLACE ASL/PLL
C                                ON DAY 1)
C
C SUMB(I)           120  REAL     TOTAL STOCKOUTS OVER ALL PARTS IN THE NO-SUB
C                                PART SET,AS CALCULATED  DAY I  DURING
C                                CAPABILITY ASSESSMENT
C
C TSTK(J)           300  REAL     THE CUMULATIVE STOCK DEPLOYED FOR PART J ON
C                                THE DAY BEING PROCESSED
C
      COMMON
     +    AC(120),        ACL,            ADESC(300),     ALLOW1(120),
     +    ALLOWB(120),    AMSN(300),      ASURV(120),     AVAVG(6),
     +    AVM(120),       BCY(300),       BF(300),        CASE,
     +    COMDA(300),     CF(300),        CL,             CHINT,
     +    CNCS(300),      COST(300),      CRNCS(300),     DCOST1(300),
     +    DCOSTF(120),    DCY(300),       DF(300),        DMD(300),
     +    DOD(300),       FHA(120),       FHM,            FHPAPO(3,120),
     +    FHR(120),       ICOST,          IDCC(2),        IFHC(120),
     +    IFS(300),       INSEL,          INS(300),       INT,
     +    IPT(100),       IRC(300),       IRO(300),       ISHORT,
     +    NP,             NP1,            NP2,            NW,
     +    PTOEP(300,24),  QPA(300),       RNC(120),       RNCS(300),
     +    SM(120,100),    SRMAX1(300),    STK(300),       SUMB(120),
     +    TRNCS(300),     TSTK(300),      TSUMB
      CHARACTER*16
     +    ADESC,          ADSC,           AMSN,           CASE,
     +    RAV
```

```
      TAV=0.
      TAV1=0.
      DO 100 I=1,NP
        TSTK(I)=STK(I)
        DOD(I)=0.
  100 DMD(I)=0.
      DO 300 L=1,NW
        DO 200 I=1,3
  200   FHPAPD(I,L)=0.
  300 SUMB(L)=0.
      DO 400 I=1,3
  400 AVAVG(I)=0.
C
C THRU STMT 1000 PROCESS EACH DAY I
C
      DO 1000 I=1,NW
        IA=(I-1)/5+1
C
C SET TSTK(I)= ISSUED INITIAL STK THRU DAY I
C
        DO 500 J=1,NP
  500   TSTK(J)=TSTK(J)+PTDEP(J,IA)/5.
        BMAX=0.
        IF (NP2.EQ.0) GO TO 700
C
C THRU STMT 500 DO NMCS ACFT ASSESSMENT FOR THE NO-SUB SET.
C ZP=NET DEMAND (BACKORDERS)FROM PART K SUMB(I)= TOTAL NO-SUB BACKORDERS
C =TOTAL NMCS ACFT FROM ALL NO-SUB PARTS ON DAY I.
C
        DO 600 K=1,NP2
          II=INS(K)
          X=DMD(II)
          DMD(II)=SR(I,II,X)
          ZP=RNCS(II)
          IF (IND.EQ.2) ZP=RNCS(II)+TSTK(II)
  600   SUMB(I)=SUMB(I)+AMAX1(0.,DMD(II)-ZP)
  700   IF (NP1.EQ.0) GO TO 900
C
C THRU STMT 700 DO NMCS ACFT ASSESSMENT FOR THE FULL-SUB SET.
C BOFCS=NET DEMAND (BACKORDERS)FROM PART K/OPA = NMCS ACFT FROM THIS
C FULL-SUB PART. BMAX = TOTAL NMCS ACFT FROM ALL FULL-SUB PARTS PROCESSED
C
        DO 800 K=1,NP1
          II=IFS(K)
          X=DMD(II)
          DMD(II)=SR(I,II,X)
          ZP=RNCS(II)
          IF (IND.EQ.2) ZP=RNCS(II)+TSTK(II)
          BOFCS=(DMD(II)-ZP)/OPA(II)
          IF (BOFCS.LE.0.) BOFCS=0.
          BMAX=AMAX1(BMAX,BOFCS)
  800   CONTINUE
C
C CALC ACFT AVAILABLE (RNC(I)) FOR DAY I AS SURVIVING ACFT-TOTAL COMBINED
C (ALL PARTS) NMCS ACFT. CALC PGM FLYING HRS/ACFT/DAY(FHPAPD(1,I)) AND
C ACCUMULATE (TAV1) THE ACFT AVAILABLE.
C
  900   RNC(I)=AMAX1(0.,ASURV(I)-BMAX-SUMB(I))/(ASURV(I)+.00001)
        FHPAPD(1,I)=AMIN1(FHM,FHR(I)/(ASURV(I)-BMAX-SUMB(I))+.0001)
        TAV1=TAV1+RNC(I)*ASURV(I)
 1000 CONTINUE
      TSURV=0.
C
C PRINT THE TABLE OF DAILY UNCONSTR COST CAPABILITY ASSESSMENT W/AVGS
C
      DO 1200 I=1,NW
        AX=1.-(ALLOWB(I)/(ASURV(I)+.000001))
        IF (MOD(I-1,50).NE.0) GO TO 1100
        WRITE (6,1400) CASE
        WRITE (6,1500)
        IF (IND.EQ.1) WRITE (6,1600)
        IF (IND.EQ.2) WRITE (6,1700)
        WRITE (6,1800)
        WRITE (6,1800)
        WRITE (6,1950)
        WRITE (6,2000)
        WRITE (6,2100)
        WRITE (6,1800)
 1100   TSURV=TSURV+ASURV(I)
C
C CALC AVG ACFT AVAILABLE(AVAVG(1)),WEIGHTED BY DAILY NR OF ACFT SURVIVING.
C CALC AVG PGM FLYING HRS/ACFT/DAY(AVAVG(3)),WEIGHTED BY DAILY NR OF ACFT
```

```
      C AVAILABLE.
      C
              AVAVG(1)=AVAVG(1)+RNC(I)*ASURV(I)
              AVAVG(2)=AVAVG(2)+AX*ASURV(I)
              AVAVG(3)=AVAVG(3)+FHPAPD(1,I)*RNC(I)*ASURV(I)/(TAV1+.0001)
              RAV='  FLYING HP PROG'
              IF (IFHC(I).EQ.1) RAV=' AVAIL CONSTRAIN'
       1200 WRITE (6,2200) I,RNC(I),AX,RAV,AVM(I),FHPAPD(1,I),I
            DO 1300 K=1,2
       1300 AVAVG(K)=AVAVG(K)/TSURV
            WRITE (6,2300) (AVAVG(K),K=1,3)
            RETURN
       1400 FORMAT (1H1,30X,'CASE= ',A16)
       1500 FORMAT (/,1X,'** FORCE  CAPABILITY GIVEN THAT THE COMPUTED',' REQU
           +IREMENT (FOR EACH POLICY) IS STOCKED **')
       1600 FORMAT (//,1X,'*** ASSUMES TOTAL(INIT ST(=0) REQMTS',' STOCKED AT
           +RETAIL(NO POST D-DAY PARTS DEPLOYED) ***')
       1700 FORMAT (//,15X,'*** CASES ASSUME RESIDUAL(INIT STK=CURR STK)',' RE
           +QMTS  ARE STOCKED AND DEPLOYED  ***')
       1800 FORMAT (/)
       1950 FORMAT (/,16X,'AIRCRAFT AVAILABILITY',27X,'ACHIEVED')
       2000 FORMAT (21X,'ACHIEVED',33X,'FLY HRS/AC')
       2100 FORMAT(14X,'DAY',6X,'AVAIL',' REQ AVAIL   AVAIL',' SOURCE',' AVAI
           +L',6X,'/DAY',5X,'DAY')
       2200 FORMAT (14X,I4,F10.3,6X,F5.3,A16,F5.2,F10.1,I8)
       2300 FORMAT (/,1X,'   AVERAGE= ',10X,F5.3,6X,F5.3,21X,F10.1)
            END
```

# SUBROUTINE UCRQPS

```
      SUBPOUTINE UCRQPS (IND,IOPT4,IOPT5,IORD)
C NAME: UCRQPS              TYPE: SUBROUTINE
C
C PURPOSE: THE UCRQPS (UNCONSTRAINED COST RQMNTS-PARTIAL SUBSTITUTION)
C SUBROUTINE COMPUTES AND PRINTS THE LEAST COST RQMNTS MIX OF SPARE PARTS
C PARTS NEEDED,GIVEN UNCONSTRAINED FUNDS,TO ACHIEVE THE CASE OBJECTIVE
C
C CALLED BY: MAIN PROGRAM
C
C CALLS
C     -FUNCTION SR: COMPUTES CUMULATIVE NET DEMAND THRU A SPECIFIED DAY
C                   FOR A SPECIFIED PART
C     -SUBROUTINE MAXC: ORDERS LIST OF PART RQMNTS TO BE PRINTED
C     -SUBROUTINE NCRNC: COMPUTES THE  RQMNT SOLUTION FOR THE 'NO SUB' PART
C                        SET AND A SPECIFIC ALLOWED STOCKOUT FOR THAT SET
C
C FILES USED : INPUT - NONE
C              OUTPUT - UNIT 6 (PRINT)
C
C
C ARGUMENTS
C
C
C NAME                   TYPE            DESCRIPTION
C
C
C
C
C IND                    FIXED   INDICATOR OF WHETHER TOTAL(INIT STK=0) OR
C                                RESIDUAL(INIT STK='CURRENT INVENTORY') REQMTS
C                                ARE BEING PROCESSED .IND=1 INDICATES TOTAL
C                                REQMTS. IND=2 INDICATES RESIDUAL REQMTS.
C
C
C IOPT4                  FIXED   RUN OPTION(INPUT). IF IOPT4 .LE. 0,THEN THE
C                                UNCONSTR COST SOLUTION REQMTS LIST WILL NOT
C                                BE PRINTED (BUT WILL BE COMPUTED INTERNALLY).
C                                IF IOPT4 .GT.0 THE LIST WILL BE PRINTED.
C
C IOPT5                  FIXED   RUN OPTION(INPUT). IF IOPT5 .LE. 0,THEN THE
C                                'CUMULATIVE(UNCONSTR COST) REQMTS COSTS THRU
C                                DAY N' LIST WILL NOT BE PRINTED.IF IOPT3 .GT. 0
C                                THE LIST WILL BE PRINTED.
C
C
C IORD                   FIXED   RUN OPTION(INPUT). IF IORD .LE. 0,THEN THE
C                                SOLUTION REQMTS LISTS WILL BE ORDERED ACCORDING
C                                TO DECREASING UNIT COST OF PART.IF OPT3 .GT. 0
C                                THE REQMTS LISTS ARE ORDERED BY (DECREASING)
C                                AMOUNT OF SOLUTION REQMT.
C
C
C LOCAL ARRAYS
C
C
C NAME       DIMENSION  TYPE              DESCRIPTION
C
C RMIN(J)          300  REAL     STORES EITHER 0 OR CRNCS(J) FOR PART J
C
C
C
C
C COMMON BLOCK (UNLABELED) ENTRIES
C
C
C NAME       DIMENSION  TYPE              DESCRIPTION
C
C
C
C ACL                1  REAL     THE AMOUNT(S) OF SUSTAINABILITY DOLLARS,
C                                BASED ON THE 'CUM REQMT COST THRU DAY N'
C                                TABLES,WHICH IS THE CLOSEST APPROXIMATION
C                                TO THE INPUT  COST LIMIT FOR THE CONSTRAINED
C                                COST CASE
C
C ADESC(J)         300  CHAR     16 CHAR DESCRIPTION OF SPARE PART J
C
C ALLOW1(I)        120  REAL     THE 'ALLOWABLE NMCS ACFT' FOR THE NO-SUB
C                                SET ON DAY I,COMPUTED AFTER DAY I IS PROCESSED.
C                                AFTER IT IS CALCULATED FOR DAY I, IT IS FIXED
C                                DURING ITERATIVE CALCULATIONS (INVOLVING DAYI)
```

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C                                    FOR NO-SUB REQMTS ON LATER DAYS.
C
C ALLOWB(I)          120  REAL       MAXIMUM ALLOWABLE NMCS AC ON DAY I WHICH
C                                    WILL STILL ALLOW ACHIEVMENT OF CASE OBJECTIVE
C                                    (FLYING HOUR AND AVAILABILITY) ON DAY I
C
C ANSN(J)            300  CHAR       IDENTIFICATION NR(NSN) OF SPARE PART J
C
C CASE                    CHAR       CASE ID
C
C CDNDA(J)           300  REAL       ARRAY USED TO STORE THE CUMULATIVE NET DEMAND
C                                    (BASED ON INITIAL STK=0) FOR PART J ON THE
C                                    SCENARIO DAY BEING PROCESSED
C
C CL                   1  REAL       THE COST LIMIT (AS SPECIFIED  BY INPUT) USED
C                                    IN THE CONSTRAINED COST REQMTS CASE.
C
C CNINT                1  REAL       TOTAL COST OF THE REQMT FOR THE UNCONSTRAINED
C                                    COST CASE
C
C CNCS(J)            300  REAL       TOTAL COST  OF REQMT FOR PART J USING
C                                    THE SPECIFIED PART  REPLACEMENT POLICY.
C
C COST(J)            300  REAL       COST OF A SINGLE ITEM OF PART J . THIS IS
C                                    ALSO DENOTED AS 'PART UNIT COST'.
C
C CRNCS(J)           300  REAL       THE UNCONSTRAINED COST SOLUTION REQMT FOR
C                                    PART J AT ANY STAGE OF THE PARTIAL SUB
C                                    REQUIREMENT CALCULATION ALGORITHM.
C
C DCOST1(I)          120  REAL       THE TOTAL CUMULATIVE REQMTS COST THRU DAY I
C                                    FOR THE FULL SUB PARTS ONLY. I.E.  THIS IS
C                                    THE PORTION OF THE 'CUM REQMTS COST THRU DAY N'
C                                    ENTRY WHICH IS ASSOCIATED WITH THE FULL SUB
C                                    PART SET.
C
C DCOSTF(I)          120  REAL       CUMULATIVE COST OF THE FULL REQUIREMENT
C                                    (ALL  PARTS) THRU DAY I USING THE SPECIFIED
C                                    PART REPLACEMENT POLICY WITH UNCONSTRAINED
C                                    COST.
C
C
C
C DOD(J)             300  REAL       ARRAY STORING THE ATTRIBUTE TO BE SORTED ON
C                                    IN SUBROUTINE MAXC. IN MAIN PGM,THIS HAS PART
C                                    UNIT COST FOR PART J. IN SUBROUTINES CCLIST &
C                                    UCROPS,THIS HAS THE AMOUNT OF THE SOLUTION
C                                    REQMT FOR PART J.
C
C ICOST                1  FIXED      INDICATOR WHICH TELLS SUBROUTINE UCROPS WHETHER
C                                    TO PRINT THE PARTS REQMTS LIST (0=DO 1=DON'T).
C                                    REQMTS LIST IS NOT PRINTED DURING CONSTRAINED
C                                    COST REQMT CALCULATIONS.
C
C IDCC(IND)            2  FIXED      STORES ,FOR EITHER TOTAL(IND=1) OR RESIDUAL
C                                    (IND=2), THE LATEST DAY FROM THE ' CUM COST
C                                    REQMT THRU DAY N' TABLE (FROM THE UNCONSTR
C                                    COST CASE) FOR WHICH ASSOCIATED CUM COST
C                                    IS LESS THAN OR = THE INPUT-SPECIFIED COST
C                                    LIMIT USED IN THE CONSTRAINED COST CASE.
C
C IFS(J)             300  FIXED      ARRAY STORING THE PARCOM PART NUMBERS OF THE
C                                    PARTS IN THE FULL-SUB PART SET.
C
C INSEL                   FIXED      NUMBER OF PART TYPES FOR WHICH INDIV ITEM
C                                    'CUMULATIVE (UNCONSTR COST) SOLUTION REQMTS
C                                    THRU DAY N' ARE DESIRED. (SEE SN(I,J) &
C                                    IPT(J) BELOW)
C
C INT                  1 FIXED       THE INTERVAL AT WHICH THE PARTIAL SUB
C                                    COMPUTATION ALGORITHM (ROUTINE UCROPS)
C                                    INCREMENTS VALUES FOR 'ALLOWABLE NMCS ACFT'
C                                    AT EACH STAGE OF CALCULATION OF SEPARATE REQMT
C                                    SOLUTIONS FOR THE FULL-SUB SET AND THE NO-SUB
C                                    SET. ALWAYS SET=1 FOR RELIABLE RESULTS. ITS
C                                    VALUE IS SET =1 IN THE PROGRASM CODE.
C
C IPT(J)               5  FIXED      ARRAY STORING INTERNAL PART NRS (SUBSCRIPTS)
C                                    FOR PARTS FOR WHICH A CUMULATIVE DAY BY DAY
C                                    REQUIREMENT HISTORY IS TO BE  PRINTED
C
C IRC(J)             300  FIXED      ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
C                                    DECREASING PART UNIT COST FOR ASSOCIATED PART
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C
C IRO(J)           300  FIXED    ARRAY CONTAINING PART NUMBERS ORDERED ACC TO
C                                 DECREASING SOLUTION REQMT AMOUNT FOR ASSOCIATED
C                                 PART
C
C NP                 1  FIXED    NR OF PART TYPES PROCESSED IN RUN. (THIS
C                                 EXCLUDES PART TYPES WITH ESSENTIALITY CODE
C                                 .LE. IESS OR WITH A ZEPO FAILURE RATE)
C
C NP1                1  FIXED    TOTAL NUMBER OF 'PART NUMBERS' IN THE FULL-SUB
C                                 PART SET
C
C NP2                1  FIXED    TOTAL NUMBER OF 'PART NUMBERS' IN THE NO-SUB
C                                 PART SET
C
C NW                 1  FIXED    LENGTH(DAYS) OF SCENARIO
C
C PTDEP(J,K)    300,24  REAL     TOTAL AMOUNT OF INITIAL STOCK FOR PART J
C                                 RECEIVED AT THEATER(EXCLUDING IN-PLACE STOCK)
C                                 BETWEEN DAY 5*K-4 AND DAY 5*K
C
C QPA(J)           300  REAL     THE 'QUANTITY PER APPLICATION' FOR PART J.
C                                 I.E. THE STANDARD NUMBER OF ITEMS OF PART J
C                                 INSTALLED ON EACH OPERATIONAL ACFT
C
C SM(I,J)      120,100  REAL     THE CUMULATIVE (UNCONSTR COST) SOLUTION REQMT
C                                 THRU DAY I FOR PART IPT(J)
C
C SRMAX1(J)        300  REAL     A WORKING VARIABLE USED IN THE CALCULATION OF
C                                 THE UNCONSTR COST REQMT FOR A PART J IN THE
C                                 FULL-SUB SET. IT IS THE RUNNING MAXIMUM (OVER
C                                 TIME) OF THE NET DEMAND (INCLUDING INITIAL STK)
C                                 FOR PART J THRU THE DAY BEING PROCESSED
C
C STK(J)           300  REAL     INITIAL SERVICEABLE STOCK OF PART J. IT IS THE
C                                 SERVICEABLE WAR RESERVE + (IN-PLACE ASL/PLL
C                                 ON DAY 1)
C
C TSTK(J)          300  REAL     THE CUMULATIVE STOCK DEPLOYED FOR PART J ON
C                                 THE DAY BEING PROCESSED
C
      DIMENSION
     +     RMIN(300)
      COMMON
     +     AC(120),         ACL,             ADESC(300),      ALLOW1(120),
     +     ALLOWB(120),     AMSN(300),       ASURV(120),      AVAVG(6),
     +     AVM(120),        BCY(300),        BF(300),         CASE,
     +     CONDA(300),      CF(300),         CL,              CMINT,
     +     CNCS(300),       COST(300),       CRNCS(300),      DCOST1(300),
     +     DCOSTF(120),     DCY(300),        DF(300),         DMD(300),
     +     DOD(300),        FMA(120),        FMM,             FMPAPD(3,120),
     +     FMR(120),        ICOST,           IDCC(2),         IFMC(120),
     +     IFS(300),        INSEL,           INS(300),        INT,
     +     IPT(100),        IRC(300),        IRO(300),        ISHORT,
     +     NP,              NP1,             NP2,             NW,
     +     PTDEP(300,24),   QPA(300),        RNC(120),        RNCS(300),
     +     SM(120,100),     SRMAX1(300),     STK(300),        SUMB(120),
     +     TRNCS(300),      TSTK(300),       TSUMB
      CHARACTER*16
     +     ADESC,           ADSC,            AMSN,            CASE
      DO 100 K=1,INSEL
        DO 100 I=1,120
  100 SM(I,K)=0.
      DO 200 J=1,NP
        TSTK(J)=STK(J)
        RNCS(J)=0.
        CRNCS(J)=0.
        CONDA(J)=0.
  200 SRMAX1(J)=-999.
C
C INITIALIZE ACHIEVED DAILY STOCKOUTS FROM NO-SUB PARTS
C
      DO 300 I=1,NW
        ALLOW1(I)=ALLOWB(I)
        DCOST1(I)=0.
  300 DCOSTF(I)=0.
C
C THRU STMT 1600 COMPUTE THE UNCONSTR COST REQMTS SOLUTION. PROCESS
C ALL PARTS ON EACH SUCCESIVE DAY
C
      DO 1600 I=1,NW
        IA=(I-1)/5+1
```

```
            TALLOW=ALLOWB(I)
            CMINT=99999999999.
            NA=ALLOWB(I)+1.5
            DO 400 J=1,NP
              TSTK(J)=TSTK(J)+PTDEP(J,IA)/5.
  400       RMIN(J)=0.
            ZINT=INT
            IADD=0
            IF (MOD(NA-1,INT).NE.0) IADD=1
            MULT=((NA-1)/INT)+IADD
            NAD=MULT*INT+1
            LAST=0
C
C THRU STMT 1500, COMPUTE REQMTS AND COSTS SEPARATELY FOR THE FULL-SUB
C AND THE NO-SUB PART SETS FOR ALL COMBINATIONS I1,I2 WITH I1+I2=
C (ALLOWED NMCS ACFT FOR DAY I) + 1
C
            DO 1500 L1=1,NAD,INT
              L2=MINO(L1,NA)
              I1=L2-1
              I2=NA-I1-1
              ALLOW1(I)=I2
C
C IF THERE ARE NO FULL-SUB PARTS,SKIP FULL-SUB PROCESSING
C
              IF (NP1.EQ.0) GO TO 700
C
C THRU STMT 600 , DO REQMT CALCULATIONS ON THE FULL-SUB PART SET
C
              DO 600 JA=1,NP1
                J=IFS(JA)
                IF (L2.GT.1) GO TO 500
                CDMD=CDMDA(J)
C
C COMPUTE NET DEMAND FOR PART J BASED ON INIT STK=0 THEN ADJUST(XXX)
C FOR DISTRIBUTED STOCK
C
                CDMDA(J)=SR(I,J,CDMD)
                XXX=CDMDA(J)
                IF (IND.EQ.2) XXX=XXX-TSTK(J)
                IF (XXX.GE.SRMAX1(J)) SRMAX1(J)=XXX
C
C COMPUTE THE DAY REQMT
C
                CRNCS(J)=AMAX1(0.,SRMAX1(J))
                GO TO 600
  500           IF (L1.GE.NA) ZINT=NA-LAST
C
C WHEN THE ALLOWED NMCS ACFT IS INCREASED BY INT,THEN THE REQMT FOR
C A PART IS REDUCED BY INT*QPA. (INT=1 AS SET IN THE MAIN PROGRAM)
C
                CRNCS(J)=AMAX1(0.,CRNCS(J)-ZINT*QPA(J))
C
C CALC REQMT FOR EACH PART J OF THE FULL-SUB PART SET,THRU THIS COMBINATION
C OF I1 & I2,AS THE MAX OF THE DAY REQMTS (FOR THE PART) OVER ALL DAYS PROCESSED
C
  600         CRNCS(J)=AMAX1(CRNCS(J),RNCS(J))
C
C CALL THE NO-SUB REQMTS CALCULATION ROUTINE TO OPERATE ON THE NO-SUB
C PART SET
C
  700       IF (NP2.GT.0) CALL NCRNC (I,I2,IND)
            TOTC=0.
C
C CALCULATE TOTAL REQMTS COST FOR THIS COMBINATION OF I1,I2
C
            DO 800 J=1,NP
  800       TOTC=TOTC+COST(J)*CRNCS(J)
            IF (TOTC.GE.CMINT) GO TO 1000
            TALLOW=I2
            CMINT=TOTC
C
C USE ONLY THR REQMTS FROM THE 'CHEAPEST' COMBINATION OF I1 & I2
C
            DO 900 J=1,NP
  900       RMIN(J)=CRNCS(J)
 1000       IF (L2.NE.NA.AND.NP1.NE.0) GO TO 1400
C
C ASSUMING THERE ARE SOME FULL-SUB PARTS IN THIS POLICY,DON,T DO
C FINAL CALCULATIONS UNLESS ALL COMBINATIONS HAVE BEEN CHECKED
C
C
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```
C COMPUTE THE FINAL REQMT FOR EACH PART AS THE LARGEST OF THE PART
C REQMTS FOR THE 'CHEAPEST' COMBINATIONS OF I1 & I2
C
              DO 1200 J=1,NP
                RNCS(J)=AMAX1(RMIN(J),RNCS(J))
C
C COMPUTE 'CUM REQMT COST (ALL PARTS ) THRU DAY I'
C
                DCOSTF(I)=DCOSTF(I)+RNCS(J)*COST(J)
C
C STORE 'CUM REQMT THRU DAY N' FOR THE PARTS SPECIFIED IN INPUT
C
                DO 1100 M=1,IMSEL
                  IF (J.EQ.IPT(M)) SM(I,M)=RNCS(J)
 1100           CONTINUE
 1200         CNCS(J)=COST(J)*RNCS(J)
              IF (NP1.EQ.0) GO TO 1600
C
C STORE 'CUM REQMTS COST THRU DAY I' FOR JUST THE FULL-SUB PARTS IN THE
C TOTAL(ALL PARTS) REQMT
C
              DO 1300 J=1,NP1
                II=IFS(J)
 1300         DCOST1(I)=DCOST1(I)+RNCS(II)*COST(II)
 1400         IF (NP1.EQ.0) GO TO 1600
 1500       LAST=L1
C
C SET ALLOWABLE NMCS ACFT FOR THE DAY JUST PROCESSED TO THE VALUE OF
C I2 USED IN COMPUTING THE SOLUTION REQMT FOR THAT DAY
C
            ALLOW1(I)=TALLOW
 1600 CONTINUE
        IF (ICOST.EQ.1) RETURN
C
C PRINT THE TOTAL REQMT COST
C
        WRITE (6,2800) CASE
        IF (IND.EQ.1) WRITE (6,2900)
        IF (IND.EQ.2) WRITE (6,3000)
        IF (ICOST.EQ.1) WRITE (6,3100) CL,ACL,IDCC(IND)
        WRITE (6,3200)
        WRITE (6,3300) CMINT
        IF (ICOST.EQ.1) RETURN
        IF (IORD.LE.0) GO TO 1900
        IF (ICOST.EQ.1) RETURN
        IF (IOPT4.LE.0.AND.ICOST.EQ.0) GO TO 2200
C
C IF IORD .GT. 0 ORDER THE REQMTS  ACC TO DECREASING AMOUNT OF REQMT
C
        DO 1700 I=1,NP
          IRO(I)=0
 1700 DOD(I)=RNCS(I)
        NDUMMY=NP
        DO 1800 K=1,NP
          CALL MAXC (NDUMMY,NOUT)
          IRO(K)=NOUT
          II=IRO(K)
 1800 DOD(II)=-1.
C
C PRINT THE LIST OF REQMTS FOR ALL PARTS
C
 1900 DO 2100 I=1,NP
          II=IRO(I)
          IF (IORD.LE.0) II=IRC(I)
          IF (MOD(I-1,50).NE.0) GO TO 2000
          WRITE (6,2800) CASE
          IF (IND.EQ.1) WRITE (6,3400)
          IF (IND.EQ.2) WRITE (6,3500)
          WRITE (6,3600)
          IF (ICOST.EQ.1) WRITE (6,3100) CL,ACL,IDCC(IND)
          WRITE (6,3600)
          WRITE (6,3800)
          WRITE (6,3600)
 2000     TC=100.*CNCS(II)/(CMINT+.000001)
 2100 WRITE (6,3900) I,II,AMSN(II),ADESC(II),RNCS(II),CNCS(II),TC
 2200 IF (ICOST.EQ.1) RETURN
        ICOST=1
        IF (IOPT5.LE.0) GO TO 2500
C
C PRINT THE TABLE OF 'CUM REQMT THRU DAY N' FOR THE (UP TO 100) PARTS
C SPECIFIED IN INPUT
C
```

```
      NN=IMSEL/5
      IF (MOD(IMSEL,5).NE.0) NN=NN+1
      IF (NN.GT.20) NN=20
      DO 2400 L=1,NN
        M1=IPT(1+(L-1)*5)
        M2=IPT(2+(L-1)*5)
        M3=IPT(3+(L-1)*5)
        M4=IPT(4+(L-1)*5)
        M5=IPT(5+(L-1)*5)
        DO 2300 I=1,NW
          IF (MOD(I-1,50).NE.0) GO TO 2300
          WRITE (6,2800) CASE
          IF (IND.EQ.1) WRITE (6,4000)
          IF (IND.EQ.2) WRITE (6,4100)
          WRITE (6,3600)
          WRITE (6,4200) M1,M2,M3,M4,M5
          WRITE (6,3600)
          WRITE (6,4300) AMSN(M1),AMSN(M2),AMSN(M3),AMSN(M4),AMSN(M5)
          WRITE (6,4300) ADESC(M1),ADESC(M2),ADESC(M3),ADESC(M4),ADESC(M
          5)
          WRITE (6,4400)
          WRITE (6,3600)
 2300   WRITE (6,4500) (I,SM(I,K+(L-1)*5),K=1,5)
 2400 CONTINUE
 2500 IDCC(IND)=0
C
C PRINT THE TABLE OF 'CUM REQTS COST THRU DAY N'
C
      DO 2700 I=1,NW
        IF (MOD(I-1,50).NE.0) GO TO 2600
        WRITE (6,2800) CASE
        IF (IND.EQ.1) WRITE (6,4600)
        IF (IND.EQ.2) WRITE (6,4700)
        WRITE (6,3600)
        WRITE (6,4800)
 2600   IF (DCOSTF(I).GT.CL) GO TO 2700
        IDCC(IND)=I
        ACL=DCOSTF(I)
 2700 WRITE (6,4900) I,DCOSTF(I)
      WRITE (6,3100) CL,ACL
      WRITE (6,3150) IDCC(IND)
      RETURN
 2800 FORMAT (1H1,10X,'CASE= ',A16)
 2900 FORMAT (/,1X,'TOTAL(INIT STK= 0) COST OF RQMTS')
 3000 FORMAT (/,1X,'RESIDUAL(INIT STK=CURR STK) COST OF RQMTS')
 3100 FORMAT (//,10X,'COST LIMIT OF',F12.0,' APPROXIMATED BY',F12.0)
 3150 FORMAT (//,10X,'WHICH IS THE CUM RQMT COST THRU DAY',I4)
 3200 FORMAT (/,'  POLICY              TOT COST')
 3300 FORMAT (/,' PART  SUB',F14.0)
 3400 FORMAT (/,30X,' TOTAL(INIT STK=0)  STK RQMTS   ')
 3500 FORMAT (/,30X,'RESIDUAL(INIT STK=CURR STK) STK RQMTS  ')
 3600 FORMAT (/)
 3800 FORMAT (10X,'PART NR',17X,'PART',21X,'RQMNT',7X,'COST  %COST')
 3900 FORMAT (2X,I5,I10,5X,A16,2X,A16,F8.1,F12.0,F6.2,4X)
 4000 FORMAT (/,42X,'CUM TOTAL RQMT(INIT STK=0) REQUIRED THRU GIVEN DAY'
     +)
 4100 FORMAT (/,42X,'CUM ADD-ON RQMT(INIT STK=CURR INV) REQUIRED ','THRU
     + GIVEN DAY')
 4200 FORMAT (13X,5(6X,'PART NR',I5,6X))
 4300 FORMAT (13X,5(A16,8X))
 4400 FORMAT (15X,'DAY',21X,'DAY',21X,'DAY',21X,'DAY',21X,'DAY')
 4500 FORMAT (8X,5(I10,F8.1,6X))
 4600 FORMAT (/,2X,'CUM TOTAL(INIT STK=0) COST OF REQ THRU GIVEN DAY')
 4700 FORMAT (/,2X,'CUM RESIDUAL(INIT STK= CURR STK) COST OF REQ THRU',
     +' GIVEN DAY')
 4800 FORMAT (/,6X,'DAY',3X,'   PART SUB')
 4900 FORMAT (6X,I3,3X,2F11.0)
      END
```

```
C                                         CONSTRAINED COST ADD-ON REQMT)  IS STOCKED.
C                                         THIS IS RECURSIVELY COMPUTED.
C
      COMMON
     +     AC(120),          ACL,              ADESC(300),       ALLOW1(120),
     +     ALLOWB(120),      AMSN(300),        ASURV(120),       AVAVG(6),
     +     AVM(120),         BCY(300),         BF(300),          CASE,
     +     CDMDA(300),       CF(300),          CL,               CMINT,
     +     CNCS(300),        COST(300),        CRNCS(300),       DCOSTI(300),
     +     DCOSTF(120),      DCY(300),         DF(300),          DMD(300),
     +     DOO(300),         FHA(120),         FHM,              FHPAPD(3,120),
     +     FHR(120),         ICOST,            IDCC(2),          IFHC(120),
     +     IFS(300),         IMSEL,            INS(300),         INT,
     +     IPT(100),         IRC(300),         IRO(300),         ISHORT,
     +     NP,               NP1,              NP2,              NW,
     +     PTDEP(300,24),    OPA(300),         RNC(120),         RNCS(300),
     +     SM(120,100),      SRMAX1(300),      STK(300),         SUMB(120),
     +     TRNCS(300),       TSTK(300),        TSUMB
      CHARACTER*16
     +     ADESC,            ADSC,             AMSN,             CASE
C
C  CALC (ID,IB) THE DAYS ON WHICH 'ITEMS RETURNING TODAY(DAY I)
C  FROM DEPOT' FAILED.
C
      ID=I-DCY(J)
      IB=I-BCY(J)
      DRR=0.
      BRR=0.
C
C  CALC (DRR) RETURNING REPAIRS(RETURNING ON DAY I)FROM DEPOT  AND
C CALC (BRR) RETURNING REPAIRS FROM RETAIL. THEN DETERMINE CUMULATIVE
C  NET DEMAND (THRU TODAY(DAY I)) BY ADD NET DEMANDS GENERATED
C  TODAY TO CUMULATIVE NET DEMANDS THRU YESTERDAY,
C
      IF (ID.GT.0) DRR=DF(J)*FHA(ID)
      IF (IB.GT.0) BRR=BF(J)*FHA(IB)
      SR=CDMD+CF(J)*FHA(I)-DRR-BRR
      RETURN
      END
```

## APPENDIX B

## REFERENCES

1. Aircraft Spares Stockage Methodology (Aircraft Spares) Study, CAA-SR-84-12, US Army Concepts Analysis Agency, April 1984

2. Overview/PARCOM Turnkey Project (OPTP), CAA-SR-84-33, US Army Concepts Analysis Agency, November 1984

3. Parts Requirements and Cost Model (PARCOM) User's Guide, CAA-D-84-10, US Army Concepts Analysis Agency, October 1984

4. Parts Requirements and Cost Model (PARCOM) Functional Description, CAA-D-84-15, US Army Concepts Analysis Agency, October 1984

5. Partial Substitution and other Modifications to the PARCOM Model, CAA-TP-84-11, US Army Concepts Analysis Agency, November 1984

6. Extended Parts Requirements and Cost Model (PARCOM) User's Guide, CAA-D-85-2, US Army Concepts Analysis Agency, March 1985

# GLOSSARY

## ABBREVIATIONS, ACRONYMS, AND SHORT TERMS

| | |
|---|---|
| acft | aircraft |
| AF | allowed stockouts over the full-sub part set |
| AFH | achievable flying hours |
| AFLC | Air Force Logistics Command |
| AMC | US Army Materiel Command |
| AN | allowed stockouts over the no sub part set |
| AR | Army regulation |
| ASL | authorized stockage list(s) |
| avail | availability |
| avg | average |
| AVIM | aviation intermediate maintenance |
| AVSCOM | US Army Aviation Systems Command |
| AVUM | aviation unit maintenance |
| BC | retail (base) condemnation rate |
| BR | retail repair time |
| CAA | US Army Concepts Analysis Agency |
| calc | calculation(s) |
| CCSS | Commodity Command Standard System |
| CONUS | Continental United States |
| cont | continued |
| cum | cumulative |
| curr | current |
| DC | depot condemnation rate |

| | |
|---|---|
| DCSLOG | US Army Deputy Chief of Staff for Logistics |
| DESCOM | US Army Depot Systems Command |
| dmd | demand |
| DOD | Department of Defense |
| DRT | depot repair time |
| EFH | estimated flying hours |
| est | estimated |
| FH | flying hour(s) |
| FHP | flying hour program |
| fly hr | flying hour |
| FS | full sub (phase) |
| full sub | full substitution (replacement policy) |
| hr | hour |
| init | initial |
| MFHAD | maximum flying hours per aircraft per day |
| min | minimum |
| MSC | major subordinate command |
| NMC | not mission capable |
| NMCS | not mission capable (due to) supply |
| no sub | no substitution (replacement policy) |
| NS | no sub (phase) |
| NRTS | not repairable (at) this station |
| OPTP | Overview/PARCOM Turnkey Project |
| OST | order and ship time |
| PARCOM | Parts Requirements and Cost Model |
| pgm | (flying hour) program |

| | |
|---|---|
| PLL | prescribed load list(s) |
| pt | part |
| ret | returning (repairs) |
| QPA | quantity per application |
| rqmt(s) | requirement(s) |
| sub | substitution |

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